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FAILURE INFORMATION NOTEBOOK

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QUALITY AND RELIABILITY ASSURANCE LABORATORY

National Aeronautics and Space Administration



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March 1, 1966

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FAILURE INFORMATION NOTEBOOK

ABSTRACT

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The Failure Information Notebook (FIN) catalogs recorded operational data in the running time system for major components of the electronic, electromechanical, and mechanical systems of the Saturn I launch vehicle and associated ground support equipment.

The total operating time or cycles, qualification tests, failure categories and frequencies, failure rates, and observed Mean Time Before Failure (MTBF) are given in this composite reference source. All components are indexed to permit a rapid comparison of data from past performance; this information could also be used in predicting future performance.

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UNUSUAL TERMS

CALENDAR TIME THE DATA REPRESENTS - The calendar time during which a specific vehicle was either undergoing tests or was ready for flight. The data includes information for components classed as spares, shelf items, and components installed in the Saturn vehicle system. Although a component type may have been used on more than one vehicle, the data is restricted to those vehicles for which time or cycle data is recorded. Launch dates serve as guidelines to assure uniformity.

COMPONENT - An article which is normally a combination of parts, subassemblies, or assemblies and is a self-contained element within a complete operating equipment.

DOUBLE AMPLITUDE (DA) - The peak-to-peak excursion of the item under vibration along the axis of vibratory forces.

FAILURE - Unsatisfactory performance of equipment as determined by judgment or measurement showing that the performance is outside proper operational specification limits.

FAILURE RATE - The number of failures per unit of time or the total number of failures over the total operating time or cycles (based on assumption of exponential distribution).

INSPECTION REPORT (IR) (MSFC Form 312) - In the form for the system used to report results of inspections (including functional) performed at MSFC for MSFC-produced items and items purchased from contractors. The following types of inspections are reported through the IR system:

Receiving inspection, manufacturing inspection, part assignment, stock retest, assembly inspection, pre-static checkout, static and post-static tests, final checkout, and engine modification.

The IR system is used for such projects as Nova, Centaur, Apollo, Rift, Saturn I, Saturn IB, and Saturn V. Only Saturn I hardware has been considered for this report.

MEAN CYCLES BETWEEN FAILURE (MCBF) - The total measured operating cycles for a population of components divided by the total number of failures.

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MEAN TIME BETWEEN FAILURE (MTBF) - The total measured operating time for a population of components divided by the total number of failures.

POINT ESTIMATE - The number of failures divided by the total operating time.

RUNNING TIME LOGS - A method for recording the operating time or cycles of time and cycle sensitive components. MSFC Form 1842 is used for recording data on components operated on Saturn vehicles. MSFC Form 1427 is used for recording data on components operated during bench tests.

UNSATISFACTORY CONDITION REPORT (UCR) (MSFC Form 233) - The form for the Unsatisfactory Condition Reporting (UCR) System, which has two major functions:

1. The UCR system is used to ensure a regulated means for reporting component failures and deficiencies, initiating follow-up action on these failures and deficiencies, reporting the results analysis, and initiating and reporting on the final corrective action taken based upon the failure analysis results.
2. The UCR system also provides a computer magnetic tape file of these failures and deficiencies and the follow-up actions taken on them. This magnetic tape file has the capability for automatically grouping the data in a variety of sequences or arrangements as needed for various studies and investigations. It is used for such purposes as supplying information on previous failures to be used in connection with failure analysis, human factors studies, reports showing repetitive failures, and various reliability and quality studies.

The UCR system is also used at Kennedy Space Center for reporting all failures and discrepancies discovered during inspections, tests, checkouts, and countdowns. This UCR data is continually transmitted between the two centers. Copies of both the original records and the magnetic tapes are interchanged and a very active liaison effort is maintained. UCR tapes and data are also made available to SATURN contractors for their utilization in product improvement.

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FAILURE INFORMATION NOTEBOOK

SUMMARY

This notebook is a compilation of failure information related to the electronic, electromechanical, and mechanical components used in the Saturn I launch vehicle system and its associated ground support equipment. It is published as a ready reference for management and engineering personnel to help in the selection of components for new space vehicles and associated ground support equipment. It will also be useful to persons performing reliability predictions and other evaluation studies.

The information contained in this notebook is based on data obtained from Marshall Space Flight Center qualification test reports, running time/cycle logs, Unsatisfactory Condition Reports (UCR), Inspection Reports (IR), and contractor time/cycle documents. Supplements to this notebook will be furnished periodically to provide current data.

INTRODUCTION

A. PURPOSE

Few data have been compiled on failures and failure rates for components used in the Saturn launch vehicle systems. Because such data would clearly be useful in performing reliability predictions and evaluation studies, and as a means of appraising actual performance in the launch vehicle systems, this Failure Information Notebook (FIN) has been prepared. This notebook is a compilation of all operational data in the running time system for major components of the electronic, electromechanical, and mechanical systems of the Saturn I launch vehicle and associated ground support equipment.

In addition, FIN includes data for which operating time has been estimated, based on interviews with personnel involved in incoming and receiving testing and checkout of various components not included in the running time system. This notebook will be updated periodically as additional information is compiled.

An observed failure rate for a component precludes the necessity for predicting its failure rate from its parts. The component failure rate can be used directly in models for reliability predictions for the next higher assembly.

FIN can be used as a guide in selecting components for application to new space vehicles and associated ground support equipment. The data sheets provided in this notebook permit a rapid comparison between performance of prototype and modified components; summary sheets combine data related to overall performance of the component type. MSFC drawing numbers are provided as an identification aid to those who might be interested in the internal configuration of the component.

B. COMPILATION METHOD

The primary sources of the data included are the MSFC running time/cycle logs, Unsatisfactory Condition Reports (UCR) Inspection Reports (IR), and contractor time/cycle documents received from cognizant MSFC laboratories. These sources are screened and analyzed for pertinent information and each component is traced by serial number or other identification to ensure data completeness.

Failure rates are derived by point estimate for components which failed one or more times. For those components for which no failures

are observed during a reported period of operating time, a failure rate is computed as the reciprocal of the Mean Time Between Failures (MTBF) resulting from calculations using the chi square (χ^2) distribution* at an arbitrary lower confidence limit of 75 percent.

The environmental test information for individual components is furnished by the MSFC laboratory responsible for the design and reliability of each component. The data sheets cite the environmental test reports by report number, date, and source.

The purpose of the "FAILURE INDICATION" category on the data sheets is to show the general types of failure occurrence and is not intended to be a detailed failure description. The indications are taken from samples of available reports of component failures.

Wherever the following types of information are available, they are listed on a standard data sheet. Unless shown to be negative, numerical values are considered to be positive.

Component nomenclature

Component vendor

Component drawing numbers

Component design life estimate

Component failure rate (per hour/per cycle)

Component operating time/cycle (total)

Total number of components represented

Total number of components failed

Environmental qualification tests performed and limits of each

Failure indication and frequency

Data source

Calendar time the data represents

*ARINC Research Corporation, Reliability Engineering, page 173, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1964.

Report number, date, and source of the qualification tests

Description of component function

Electrical requirements for proper operation

Component dimensions and weight

Illustrations: sectional views of components

In addition, FIN contains failure rates and MTBF summaries for components which are functionally and physically similar.

SECTION I
ELECTRONIC COMPONENTS

LIST OF COMPONENTS

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
I.	Electronic Components	
I.1	<u>Amplifier Boxes</u>	
I.1.1	ST-90S Amplifier Box	50M21624 8970196
I.1.2	ST-124 Amplifier Box	50M22000 10601563
I.2	<u>Computers</u>	
I.2.1	Control	50M30802 10422000 50M33301
I.2.2	Guidance SVGC/ASC-15	50M30580
I.3	<u>Inverter</u>	
I.3.1	400 VA	50M00906
I.3.2	450 VA	50M01075 50M03398
I.3.3	1800 VA	10326375
I.4	<u>Processors</u>	
I.4.1	Control Signal	50M30354 50M31251 10442644 50M32800
I.4.2	GSP-24 Guidance Signal	10422001 50M30029 50M32000

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
I.5	<u>Program Devices</u>	
I.5.1	Programmer X1	50M10280
I.5.2	Programmer P1	50M10283
I.5.3	Program Device	8960186
I.6	<u>Receivers</u>	
I.6.1	AN/DRW-13 Command	8968388 50M10418
I.7	<u>Stabilization</u>	
I.7.1	ST-90S Stabilized Platform	50M21173 8970195
I.7.2	ST-124 Inertial Platform Assembly	50M22001 10601562
I.7.3	Control Rate Gyros	50M31125 10422022
I.7.4	Control Accelerometer	50M31126 50M31127
I.8	<u>Telemetry</u>	
I.8.1	XO-4 FM/FM/PAM Transmitter	50M10029 50M10032 50M10192 50M10031 50M10030 50M10033 50M10189 8968402 8968404 8968406 8968403 8968405 8968407

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
I.8.2	XO-6 PAM/FM/FM Telemetry Multiplexer	50M10489 50M10380 50M10660 50M10662 50M10028 50M10472 50M10473 50M10152 50M10154 50M1004
I.8.3	XO-7 SS/FM Transmitter	8968457 8968458 50M10160 50M10162 50M10194 50M10673 50M10680
I.8.4	XO-10 Transmitter	50M10156 50M10158
I.8.5	XO-11 Transmitter	50M10471 50M10474
I.8.6	UHF Transmitter	10420614
I.8.7	PCM 270 Transmitter	10420613
I.8.8	Transmitter, RF Assy, P1	50M10487 50M10488
I.8.9	Transmitter, RF Assy, F-5 (Model B)	50M10671 50M10678
I.8.10	Transmitter, RF Assy, F-6 (Model A)	50M10679 50M10672

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
I.9	<u>Television</u>	
I.9.1	Camera Control	50M10254 50M10429 50M10455
I.10	<u>Transponders</u>	
I.10.1	AZUSA	50M10448 8968413 50M12266
I.10.2	Mistram	50M10123 50M12268
I.10.3	ODOP	50M12009 50M12181
I.10.4	Radar "C" Band	8961356 50M10682 50M12261
I.10.5	Radar "S" Band	8960442
I.10.6	Radar SST-131	50M10187
I.10.7	UDOP AN/DRN-7 and -11	8960300 50M10006 50M10317
I.11	<u>Altimeters</u>	
I.11.1	Radar Altimeter	50M12076
I.12	<u>Voltage Supply</u>	
I.12.1	Control Voltage Supply	10421910
I.12.2	Master Measuring Voltage Supply	40M20002 40M20881

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
I.13	<u>Environmental Control</u>	
I.13.1	Temperature Control Assembly	20M40061 20M40147

SUMMARY SHEET

Nomenclature: ST-90 S Amplifier Box

Drawing Numbers: 50M21624,
8970196

Vendor: Sperry Farragut

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,500 hr.

Failure Rate: $2245 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 445.3

Total Number of Components
this Data Represents 7

Total Hours of Operation:
1,336.6

Total Number of
Failures Reported 3

Vehicle Equipment: X
Ground Equipment:

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I.1.1
Page 1 of 7

Nomenclature: ST-90 S Amplifier Box

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
<u>1</u>	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
<u>1</u>	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-2 through SA-6 Vehicles (less flight data)

DATA SHEET	
Nomenclature: ST-90 S Amplifier Box	
Drawing Numbers: 50M21624	Vendor: Sperry Farragut
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,500 hr.	
Failure Rate: $1506 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 664.0
Number of Components this Data Represents: 3	Total Hours of Operation: 664.0
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature: <u>25°C</u>	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>50%</u>	
Random Noise:	
Sine Wave Method:	
Vibration: <u>5 g random</u>	

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I.1.1
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Nomenclature: ST-90 S Amplifier Box

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Eccentric		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 and SA-6 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: ST-90 S Amplifier Box	
Drawing Numbers: 8970196	Vendor: Sperry Farragut
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,500 hr.	
Failure Rate: $2972 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 336.5
Number of Components this Data Represents: 4	Total Hours of Operation: 672.6
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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I.1.1
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Nomenclature: ST-90 S Amplifier Box

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
<u>1</u>			
<u>1</u>			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M21624, 8970196 component:

The ST-90 S Amplifier Box contains the servo loops and associated electronics for the ST-90 platform.

Power Rating: 75 watts
Weight: 37.8 lb
Dimensions: 20 x 14 x 7.5 in.

The three failures were reported on Inspection Reports.

SUMMARY SHEET

Nomenclature: ST-124 Amplifier Box

Drawing Numbers: 50M22000,
10601563

Vendor: Bendix E. P.

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: $702 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 1422.7

Total Number of Components
this Data Represents 9

Total Hours of Operation:
2,845.5

Total Number of
Failures Reported 2

Vehicle Equipment: X
Ground Equipment:

Nomenclature: ST-124 Amplifier Box

FREQUENCY
OF
OCCURRENCE

FAILURE
INDICATIONS

FREQUENCY
OF
OCCURRENCE

FAILURE
INDICATIONS

Impedance:

Low

High

Output:

Distorted

Erratic

Excessive Null

Excessive Roll

Unwanted Signal

High

In Error

Intermittent

Loss of Some Voltages

Low

Low Sensitivity

Low Speed

No Lock On (Frequency)

Noisy

None

Oscillation/Fluctuation

Out of Specs

Out of Synchronization

Over Modulation

Overspeed

Regulation

Shorted

Reverses Polarity

Reverses Direction

Pressure:

High

Low

None

Input:

Inoperative

Fuses:

Blows/Blown

Blowers:

Inoperative

Intermittent

Mechanical:

Pins Shorted

Indicators/
Dials Are In
Error

Indicators/
Dials Are In-
operative

Lamps:

Will Not Light

Stay On

Miscellaneous:

Reported as
Burned Parts

Other:

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 vehicles (less flight data)

DATA SHEET	
Nomenclature: ST-124 Amplifier Box	
Drawing Numbers: 50M22000	Vendor: Bendix E. P.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: $782 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 1,278.1
Number of Components this Data Represents: 7	Total Hours of Operation: 2,556.2
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude: <u>3.5×10^{-5} atmosphere</u>	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>90°F</u>	
Low Temperature: <u>-35°F</u>	
Ambient Room Temperature: <u>75°F</u>	
Thermal Shock: <u>75 to -35°F</u>	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>3 to 2,000 cps</u>	
Sine Wave Method:	
Vibration:	

Nomenclature: ST-124 Amplifier Box			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Impedance: Low High Output: Distorted Scribble Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-5 through SA-10 vehicles (less CALENDAR TIME DATA REPRESENTS: flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Instrumentation and Vibration Data, Sled Run 9-1A, 30 April, 1964 Air Force Missile Development Center USAF.			

DATA SHEET	
Nomenclature: ST-124 Amplifier Box	
Drawing Numbers: 10601563	Vendor: Bendix E. P.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: $4807 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 208.0
Number of Components this Data Represents: 2	Total Hours of Operation: 289.3
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude: <u>3.5×10^{-5} atmosphere</u>	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>90°F</u>	
Low Temperature: <u>-35°F</u>	
Ambient Room Temperature: <u>75°F</u>	
Thermal Shock: <u>75 to -35°F</u>	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>3 to 2,000 cps</u>	
Sine Wave Method:	
Vibration:	

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I.1.2
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Nomenclature: ST-124 Amplifier Box

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Eccentric		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

SA-3 and SA-4 vehicle period, not
CALENDAR TIME DATA REPRESENTS: flown until SA-5 (less flight data)

COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Instrumentation and
Vibration Data, Sled Run 9-IA, 30 April, 1964 Air Force
Missile Development Center USAF.

Additional information concerning the 10601563 and 50M22000
ST-124 Amplifier Box component:

The function of the amplifier box is identical to that of the ST-90 S amplifier box. It contains the servo loops and associated electronics for the ST-90 platform.

Dimensions: 12 x 21 x 9.25 in.

Weight: 50 lb

Both failures were reported on Inspection Reports.

SUMMARY SHEET

Nomenclature: Control Computer

Drawing Numbers: 50M30802,
10422000, 50M33301

Vendor: Electronics
Communications Inc.

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 500 hr., 2,000 hr.

Failure Rate: $571 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 1,748.7

Total Number of Components
this Data Represents 21

Total Hours of Operation:
3,497.4

Total Number of
Failures Reported: 2

Vehicle Equipment: X
Ground Equipment:

Nomenclature: Control Computer

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>1</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-1 through SA-10 Vehicle (less flight data)

DATA SHEET

Nomenclature: Control Computer

Drawing Numbers: 10422000

Vendor: Electronics
Communications Inc.

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 2,000 hr.

Failure Rate: $1104 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 905.2

Number of Components
this Data Represents: 8

Total Hours of Operation: 905.2

Number of
Failures Reported: 1

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:

Acceleration:

Altitude:

Radio Interference:

Salt Spray:

Shock: 3 vert., 3 horiz. major and minor, 18 half-sine waves, 40 g

High Temperature: 4 hr. at 85°C

Low Temperature: 4 hr. at -10°C

Ambient Room Temperature:

Thermal Shock: 4 hr. at -55°C, 4 hr. at 85°C

Shock Impact (Flat Drop):

Leakage Rate: 24 hr. at 20 psi

Humidity:

Random Noise:

Sine Wave Method:

Vibration: 10-30 cps at 0.15 in. D.A., 30-2,000 cps at 7 g peak for 600 sec.

Nomenclature: Control Computer			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-1 through SA-4 vehicles (less CALENDAR TIME DATA REPRESENTS: flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Electronics Communications Inc. Report No. 5-1073 March 8, 1964.			

DATA SHEET	
Nomenclature: Control Computer	
Drawing Numbers: 50M30802	Vendor: Electronics Communications Inc.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 500 hr.	
Failure Rate: $578 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 1,729.0
Number of Components this Data Represents: 7	Total Hours of Operation: 1,729.0
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>3 vert., 3 horiz., major and minor 18 half-sine waves, 40 g</u>	
High Temperature: <u>4 hr. at 85°C</u>	
Low Temperature: <u>4 hr. at -10°C</u>	
Ambient Room Temperature:	
Thermal Shock: <u>4 hr. at -55°C, 4 hr. at 85°C</u>	
Shock Impact (Flat Drop):	
Leakage Rate: <u>24 hr. at 20 psi</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>10-30 cps at 0.15 in. D.A., 30-2,000 cps at 7 g peak for 600 sec.</u>	

Nomenclature: Control Computer			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-5 through SA-7 vehicles (less CALENDAR TIME DATA REPRESENTS: flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Electronics Communications Inc. Report No. 5-1073 March 8, 1964.			

DATA SHEET	
Nomenclature: Control Computer	
Drawing Numbers: 50M33301	Vendor: Electronics Communications Inc.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: $1604 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 623.2
Number of Components this Data Represents: 6	Total Hours of Operation: 863.2
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Reference page 3, I.2.1	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Control Computer			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning Nos. 50M30802, 10422000,
50M33301 components:

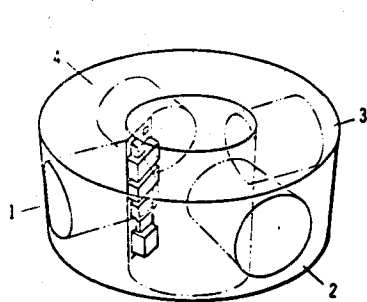
The control computer unit receives control signals from the platform stabilizer, control rate gyros and control accelerometers, shapes and sums these signals, amplifies them and provides DC outputs to drive the control actuators.

The computer's functions are related to the flight time of the vehicle and are divided into S-I powered flight (up to S-I and S-IV stage separation) and the S-IV powered flight (up to S-IV and payload separation).

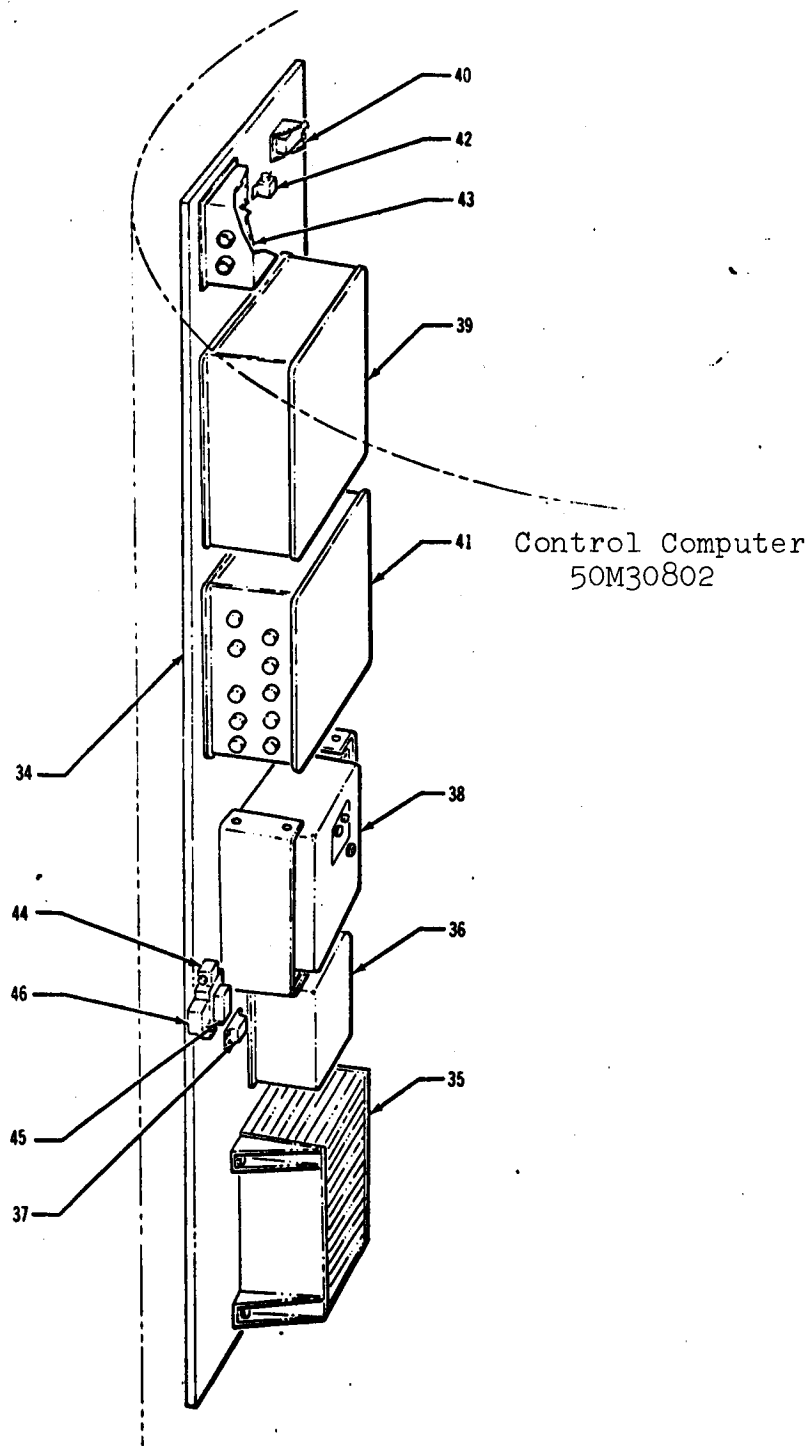
Dimensions: 17 in. diam x 20 in. length

Weight: 120 lb

Both failures occurred during operational checkout during incoming inspection. Written in Inspection Reports.

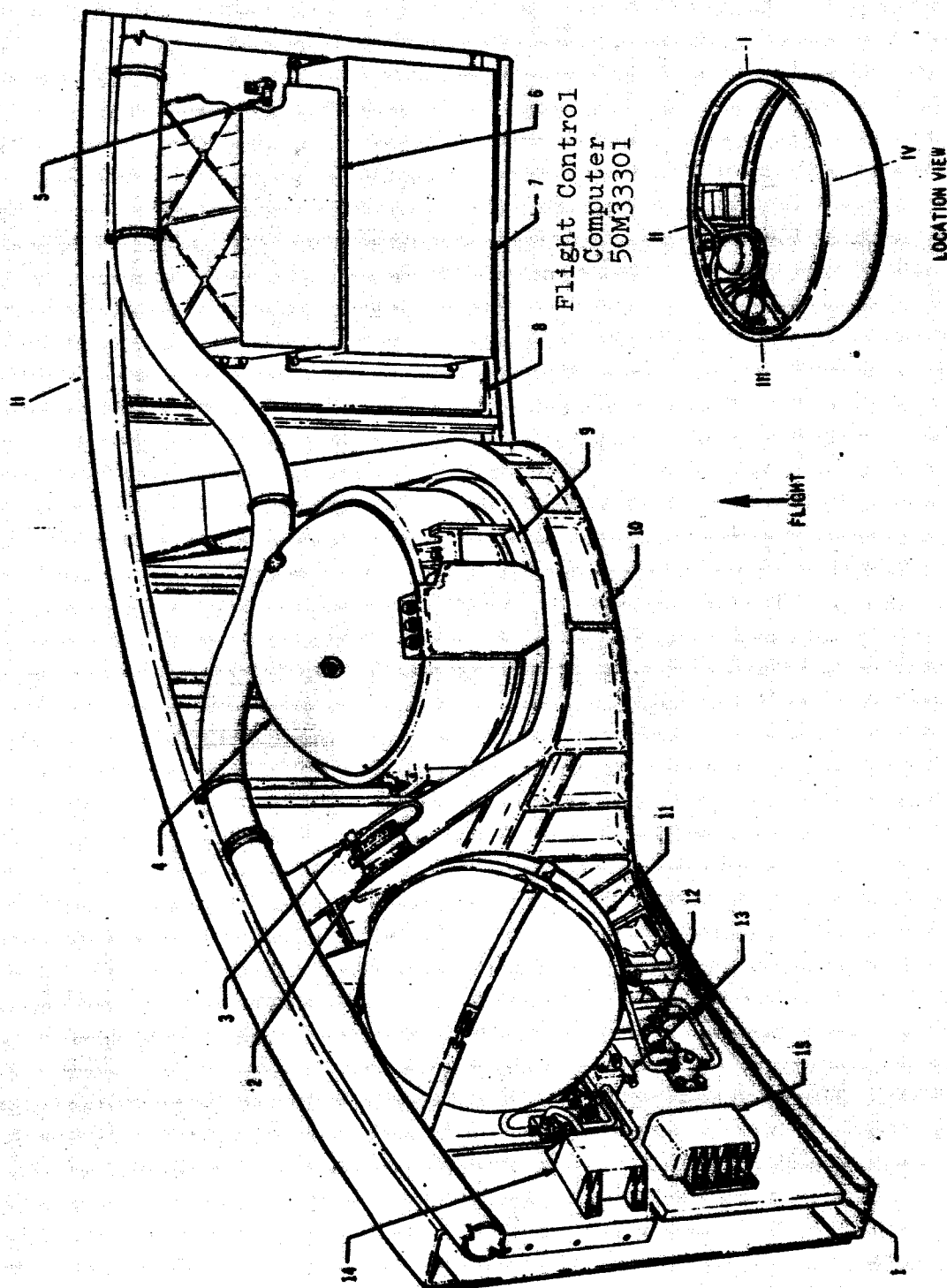


LOCATION VIEW



Control Computer
50M30802

INSTRUMENT UNIT GROUP ASSEMBLY, TUBE NO. 5 -



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DATA SHEET	
Nomenclature: Guidance Computer SVGC/ASC-15	
Drawing Numbers: 50M30580	Vendor: IBM
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life:	
Failure Rate: $372 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 2,681.9
Number of Components this Data Represents: 10	Total Hours of Operation: 3,714.5
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>Forward, 15 g, P+Y 3 g for 3 min</u>	
Altitude: <u>195,000 ft</u>	
Radio Interference: <u>0.003 to 0.00025 r</u>	
Salt Spray: <u>3% salt solution, 25°C, 48 hr.</u>	
Shock:	
High Temperature:	
Low Temperature: <u>(75 cfm) $15 \pm 2^\circ\text{C}$</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>20-30 cps at 0.04 g^2</u> <u>300-2,000 cps at 0.012 g^2 for 15 min</u>	
Sine Wave Method: <u>2.5 g rms at 20-100 cps, 3.5 g rms at</u> <u>100-300 cps, 5 g at 300-2,000 cps</u>	
Vibration:	

Nomenclature: Guidance Computer SVGC/ASC-15

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 (less flight data)

COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: IBM 63-373-2565-008,
002, 011, 005, 006 - 1963 RFI R-ASTR-ND-162 March 17,
1964

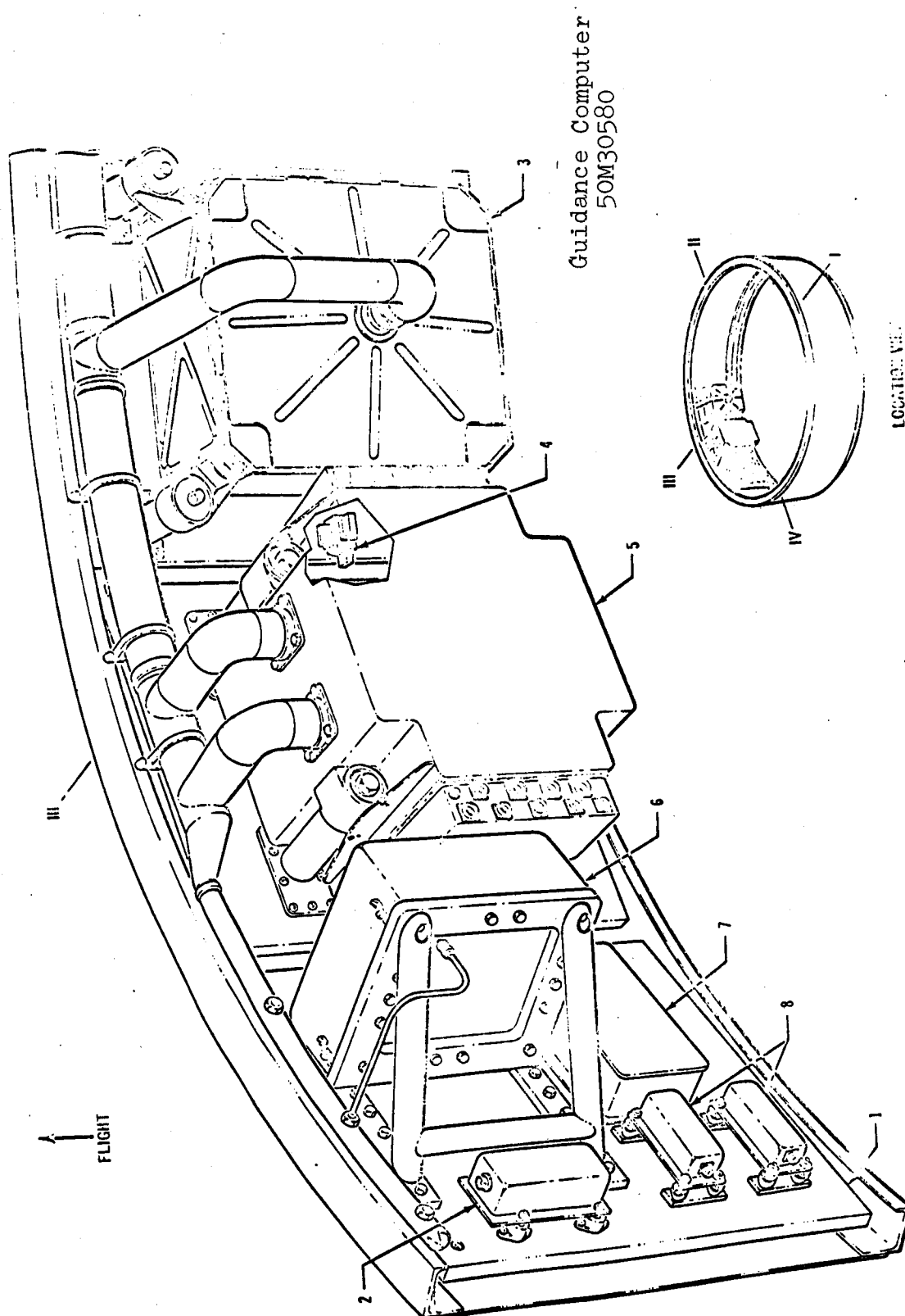
Additional information concerning the 50M30580 component:

The guidance computer SVGC/ASC-15 senses attitude and velocity inputs, determines the position of the vehicle, determines the amount of deviation between actual and desired position, and generates three outputs to correct roll, yaw, and pitch errors in vehicle attitude. It also evaluates the position and velocity data to determine when the vehicle is ready for engine cut-off, staging engine ignition, and other discrete operations and then initiates those operations.

Power Rating: 310 watts

Weight: 99 lb

Dimensions: 23 x 23 x 13 in. (6877 cu in.)



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DATA SHEET	
Nomenclature: 400 VA Inverter	
Drawing Numbers: 50M00906	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: $11,764 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 85.0
Number of Components this Data Represents: 2	Total Hours of Operation: 118.2
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: 400 VA Inverter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

SUMMARY SHEET

Nomenclature: 450 VA Inverter

Drawing Numbers: 50M01075,
50M03398

Vendor: Bendix, NASA/MSFC
Astrionics

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 2,000 hr.

Failure Rate: $736 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 1,357.5

Total Number of Components
this Data Represents 47

Total Hours of Operation:
14,933

Total Number of
Failures Reported 11

Vehicle Equipment: X
Ground Equipment:

Nomenclature: 450 VA Inverter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic	<u>3</u>	Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>2</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>3</u>	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
<u>1</u>	Regulation POOR		
<u>1</u>	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 through SA-10 vehicles (less flight data)			

DATA SHEET	
Nomenclature: 450 VA Inverter	
Drawing Numbers: 50M01075	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: $4,716 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 212
Number of Components this Data Represents: 3	Total Hours of Operations: 294.0
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude: <u>200,000 ft, 0.17 mm Hg</u>	
Radio Interference: <u>MIL-I-6181</u>	
Salt Spray:	
Shock:	
High Temperature: <u>60°C</u>	
Low Temperature: <u>-20°C</u>	
Ambient Room Temperature: <u>250°C</u>	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>21 g (4 sec), 12 g (180 sec)</u>	
Sine Wave Method:	
Vibration:	

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Nomenclature: 450 VA Inverter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Eccentric		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 vehicle only (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET

Nomenclature: 450 Volt Inverter

Drawing Numbers: 50M03398

Vendor: Bendix (E. P. Div.)

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 2,000 hr.

Failure Rate: $751 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 1,330

Number of Components
this Data Represents: 44

Total Hours of Operation: 14,639

Number of
Failures Reported: 11

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Reference 50M01075 page 3,
I.3.2

Acceleration:

Altitude:

Radio Interference:

Salt Spray:

Shock:

High Temperature:

Low Temperature:

Ambient Room Temperature:

Thermal Shock:

Shock Impact (Flat Drop):

Seepage Rate:

Humidity:

Random Noise:

Sine Wave Method:

Vibration:

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Nomenclature: 450 Volt Inverter

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Eccentric	<u>3</u>	Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>2</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>3</u>	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
<u>1</u>	Regulation Poor		
<u>1</u>	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M01075 and 50M03398 components:

Power Rating: 450 VA Outputs

Weight: 36 lb

Dimensions: 13.5 x 14 x 4.8 in.

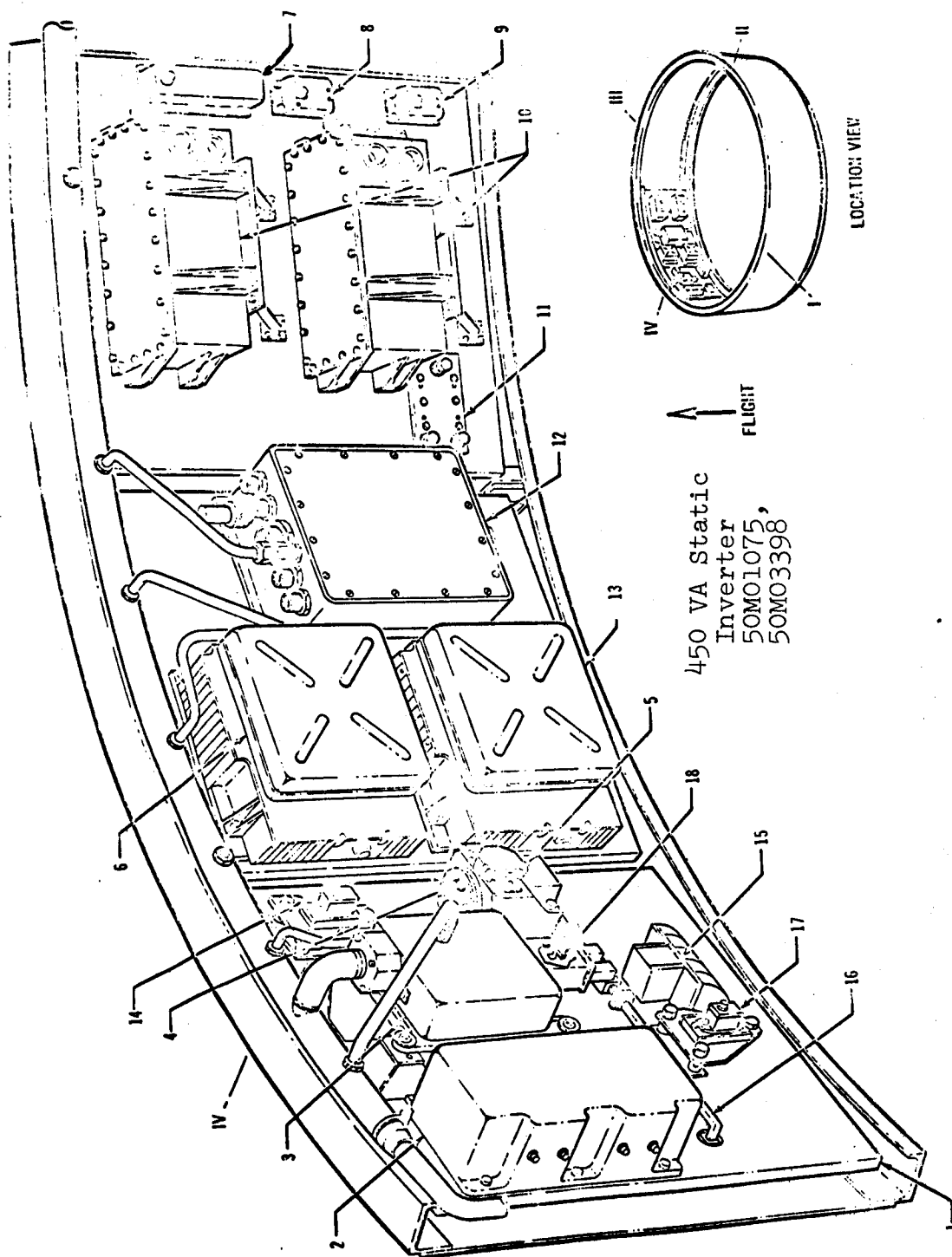
The 450 VA Inverter transforms the 28-volts dc to 115-volts ac three phase, for various components requiring this type of power.

Five of the eleven failures were reported during incoming inspection functional checkout. Two of the 5 were inoperative (would not start), one had poor regulation, one output shorted and one no output voltage.

The remaining 6 failures were reported on Unsatisfactory Condition Reports.

Two gave intermittent output, 2 had no output, 1 was inoperative and 1 gave low output.

NOTE: Analysis of the inverter after one of the "no output" failures revealed three open and/or shorted power transistors. The cause was believed to be an output phase short external to the inverter.



INSTRUMENT UNIT GROUP ASSEMBLIES -

DATA SHEET	
Nomenclature: 1,800 VA Inverter	
Drawing Numbers: 10326375 Saturn I Vehicle	Vendor: NASA/MSFC Astrionics, Ford Instrument Co. Location: Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: 3,472 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 13 Number of Failures Reported: 8	MTBF (in hours): 288.0 Total Hours of Operation: 2,304.5 * Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>0-10 g for 1.5 min, 3 planes</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>30 g, 11 milliseconds</u>	
High Temperature: <u>50°C</u>	
Low Temperature: <u>10°C</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method: <u>2 g for 10 min at 10-30 cps, 2.5 g for 10 min at 30-55 cps, 5 g for 10 min at 30-55 cps</u>	
Vibration: <u>cps</u>	

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* Minimum operating time, Serial Nos.
SFJ 1894, J 269, J209, SF 21, not in
time logs.

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Nomenclature: 1,800 VA Inverter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
<u>4</u>	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
<u>3</u>	Regulation Poor *		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-1 through SA-3 vehicles (less CALENDAR TIME DATA REPRESENTS: flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC/ASTR No. 116 (OT), May 28, 1963			

Additional information concerning the 10326375 component:

The 1,800 VA Inverter transforms the 28 volts dc to 115 volts three phase ac for various components requiring this type of power.

Power Rating: 1,800 VA Output

Weight: 46.74 lb

Dimensions: 18 x 8 x 11.5 in.

Two of the 8 failures were reported on Inspection Reports. The remaining 6 failures were reported on Unsatisfactory Condition Reports.

SUMMARY SHEET

Nomenclature: Control Signal Processor

Drawing Numbers: 50M30354,
50M31251, 10442644, 50M32800

Vendor: MSFC, Electronics
Communications Inc.

Saturn I Vehicle

Location: S-I and Instrument
Unit

Estimated Design Life: 2,000 hr.

Failure Rate: $590 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 1,694.7

Total Number of Components
this Data Represents 15

Total Hours of Operation:
1,694.7

Total Number of
Failures Reported 1

Vehicle Equipment: X
Ground Equipment:

Nomenclature:			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction	<u>1</u>	Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 vehicles (less flight data)			

DATA SHEET	
Nomenclature: Control Signal Processor	
Drawing Numbers: 50M30354	Vendor: Electronics Communications Inc.
Saturn I Vehicle	Location: S-I and Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: $6,105 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 163.8
Number of Components this Data Represents: 3	Total Hours of Operation: 227.0
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>One minute at 20 g</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>18 half sine waves at 40 g</u>	
High Temperature: <u>48 hr. at 125°C</u>	
Low Temperature: <u>25°C</u>	
Ambient Room Temperature:	
Thermal Shock: <u>2 hr. each at 100°C and -55°C</u>	
Shock Impact (Flat Drop):	
Leakage Rate: <u>1 hr. at 5.3 psig</u>	
Humidity:	
Random Noise:	
Sine Wave Method: <u>10-30 cps at 0.15 in. D.A. for 15 min.,</u> <u>30-2,000 cps at 7 g for 15 min.</u>	
Vibration:	

Nomenclature: Control Signal Processor

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Electronics Communications Inc. No. GO-30242, December 11, 1964.			

DATA SHEET	
Nomenclature: Control Signal Processor	
Drawing Numbers: 50M31251	Vendor: Electronics Communications Inc.
Saturn I Vehicle	Location: S-I and Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: $1,216 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 822.3
Number of Components this Data Represents: 6	Total Hours of Operation: 822.3
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>One minute at 20 g</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>18 half sine waves at 40 g</u>	
High Temperature: <u>48 hours at 125°C</u>	
Low Temperature: <u>25°C</u>	
Ambient Room Temperature:	
Thermal Shock: <u>2 hr. each at 100°C and -55°C</u>	
Shock Impact (Flat Drop):	
Leakage Rate: <u>1 hr. at 5.3 psig</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>10-30 cps at 0.15 in. D.A. for 15 min., 30-2,000 cps at 7 g for 15 min.</u>	

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Nomenclature: Control Signal Processor			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction	<u>1</u>	Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Electronics Communications Inc., No. GO-30242, December 11, 1964.			

DATA SHEET	
Nomenclature: Control Signal Processor	
Drawing Numbers: 10442644	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: S-I and Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: 5,000 x 10 ⁻⁶ /hr.	MTBF (in hours): 200
Number of Components this Data Represents: 2	Total Hours of Operation: 277.1
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>One minute at 20 g</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>18 half sine waves at 40 g</u>	
High Temperature: <u>48 hr. at 125°C</u>	
Low Temperature: <u>25°C</u>	
Ambient Room Temperature:	
Thermal Shock: <u>2 hr. each at 100°C and -55°C</u>	
Shock Impact (Flat Drop):	
Leakage Rate: <u>1 hr. at 5.3 psig</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>10-30 cps at 0.15 in. D.A. for 15 min., 30-2,000 cps at 7 g for 15 min.</u>	

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Nomenclature: Control Signal Processor			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 Vehicle only (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Electronics Commu- nications Inc. No. GO-30242, December 11, 1964.			

DATA SHEET	
Nomenclature: Control Signal Processor	
Drawing Numbers: 50M32800	Vendor: Electronics Communications Inc.
Saturn I Vehicle	Location: S-I and Instrument Unit
Estimated Design Life: 2,000 hr.	
Failure Rate: $3,760 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 265.9
Number of Components this Data Represents: 4	Total Hours of Operation: 368.3
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Reference: 50M31251, page 5 I.4.1	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Control Signal Processor			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-8 through SA-10 Vehicles (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

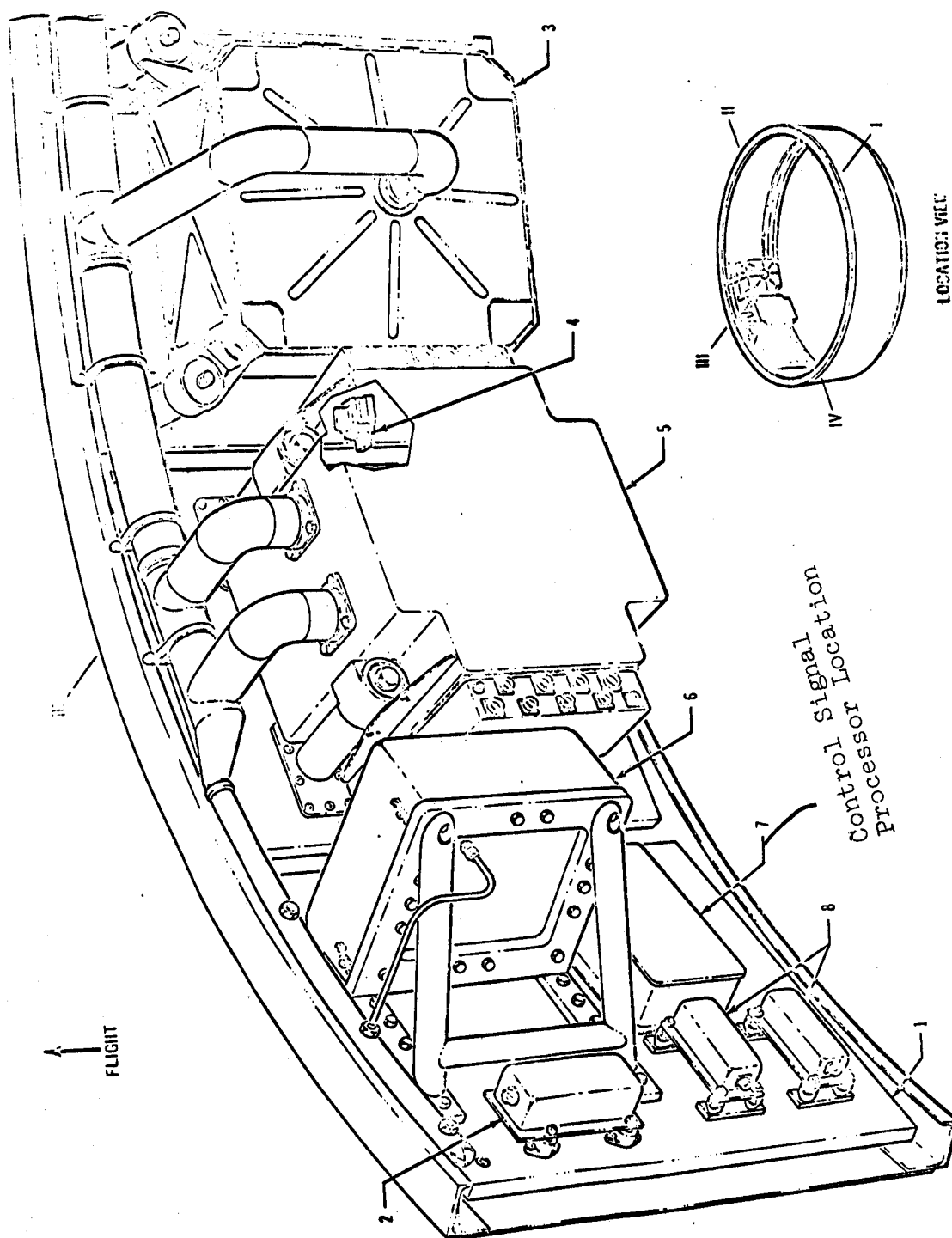
Additional information concerning the 50M30354, 50M31251,
10442644, 50M32800 Component:

The Control Signal Processor demodulates the output of the control rate gyros and conditions the input signals of the control computer.

Weight: 33 lb.

Dimensions: 16 x 15 x 6.5 in.

The only observed failure occurred during functional test at incoming inspection. It was reported on an Inspection Report.



INSTRUMENT UNIT GROUP ASSEMBLIES -

SUMMARY SHEET

Nomenclature: GSP-24 Guidance Signal Processor

Drawing Numbers: 10422001,
50M30029, 50M32000

Vendor: IBM and MSFC

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 5,000 hr.

Failure Rate: $2,162 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 462.5

Total Number of Components
this Data Represents 20

Total Hours of Operation:
5549.7

Total Number of
Failures Reported 12

Vehicle Equipment: X
Ground Equipment:

Nomenclature: GSP-24 Guidance Signal Processor

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
<u>2</u>	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
<u>1</u>	Excessive Roll		Blows/Blown
<u>1</u>	Unwanted Signal		Blowers:
	High		Inoperative
<u>3</u>	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>1</u>	Out of Specs		Other:
	Out of Synchronization		Brake Slips
	Over Modulation	<u>1</u>	
	Overspeed		
	Regulation		
	Shorted		
<u>1</u>	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 Vehicle (less flight data)

DATA SHEET	
Nomenclature: Guidance Signal Processor	
Drawing Numbers: 10422001	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 5,000 hr.	
Failure Rate: $1,161 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 860.6
Number of Components this Data Represents: 10	Total Hours of Operation: 2582.1
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>3 and 15 g for 3 min.</u>	
Altitude: <u>170,000 ft. at 50°C</u>	
Radio Interference:	
Salt Spray: <u>3% saline 25°C for 48 hr.</u>	
Shock:	
High Temperature: <u>135 and 140°F</u>	
Low Temperature: <u>103 and 106°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>10 and 60°C at 95% for 120 hr.</u>	
Random Noise: <u>0.12 g at 300 - 2000 cps, 0.04 g at 20 - 300 cps</u>	
Sine Wave Method: <u>3.5 g rms at 100 - 300 cps, 5 g rms at 300 - 2,000 cps; 2.5 g rms at 20 - 100 cps</u>	
Vibration:	

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Nomenclature: Guidance Signal Processor			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Eccentric		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
<u>1</u>	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-6 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Reports No. 64-373-5125-006, 007, 010, 011, dated 10 April 1964, 24 April 1964, 1 May 1964, 8 July 1964, 9 July 1964 - IBM.			

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Additional information concerning the 10422001, 50M30029,
50M32000 Component:

The Guidance Signal Processor integrates the guidance computer into the guidance, control, and telemetry systems of the S-I vehicle. It is an interface component which allows the functional interconnection of the stabilized platform, guidance computer, command system, control distributors and computers, ground support equipment, and the telemetry systems.

Additional information concerning the Guidance Signal
Processor GSP-24 (10422001) Components:

Power Rating: 20 watts

Weight: 6.1 lb.

Dimensions: 5 x 6 x 8 in. (240 cu in.)

This component was used on the early Saturn I flights SA-2 through SA-6 for the sole purpose of processing velocity information for telemetering.

Two failures were reported on Inspection Reports.

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DATA SHEET

Nomenclature: Guidance Signal Processor

Drawing Numbers: 50M30029

Vendor: NASA/MSFC Astrionics

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 5,000 hr.

Failure Rate: $9,990 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 100.1

Number of Components
this Data Represents: 2

Total Hours of Operation: 601.6

Number of
Failures Reported: 6

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:

Acceleration: 3 and 15 g for 3 min.

Altitude: 170,000 ft. at 50°C

Radio Interference:

Salt Spray: 3% saline at 25°C for 48 hr.

Shock:

High Temperature: 135 to 140°F

Low Temperature: 103 to 106°F

Ambient Room Temperature:

Thermal Shock:

Shock Impact (Flat Drop):

Leakage Rate:

Humidity: 10 and 60°C at 95% for 120 hr.

Random Noise: 4 g at 20 - 300 cps, 0.12 g at 300 - 2,000 cps

Sine Wave Method: 3.5 g rms at 100 - 300 cps, 5 g rms at 300 - 2,000 cps; 2.5 g rms at 20 - 100 cps

Vibration:

Nomenclature: Guidance Signal Processor			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
<u>2</u>	Distorted		Input:
	Erratic		Inoperative
<u>1</u>	Excessive Null		Fuses:
<u>1</u>	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 Vehicle Only (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Reports No. 64-373-5125-006, 007, 009, 010, 011, dated 10 April 1964, 24 April 1964, 1 May 1964, 8 July 1964, 9 July 1964, - IBM.			

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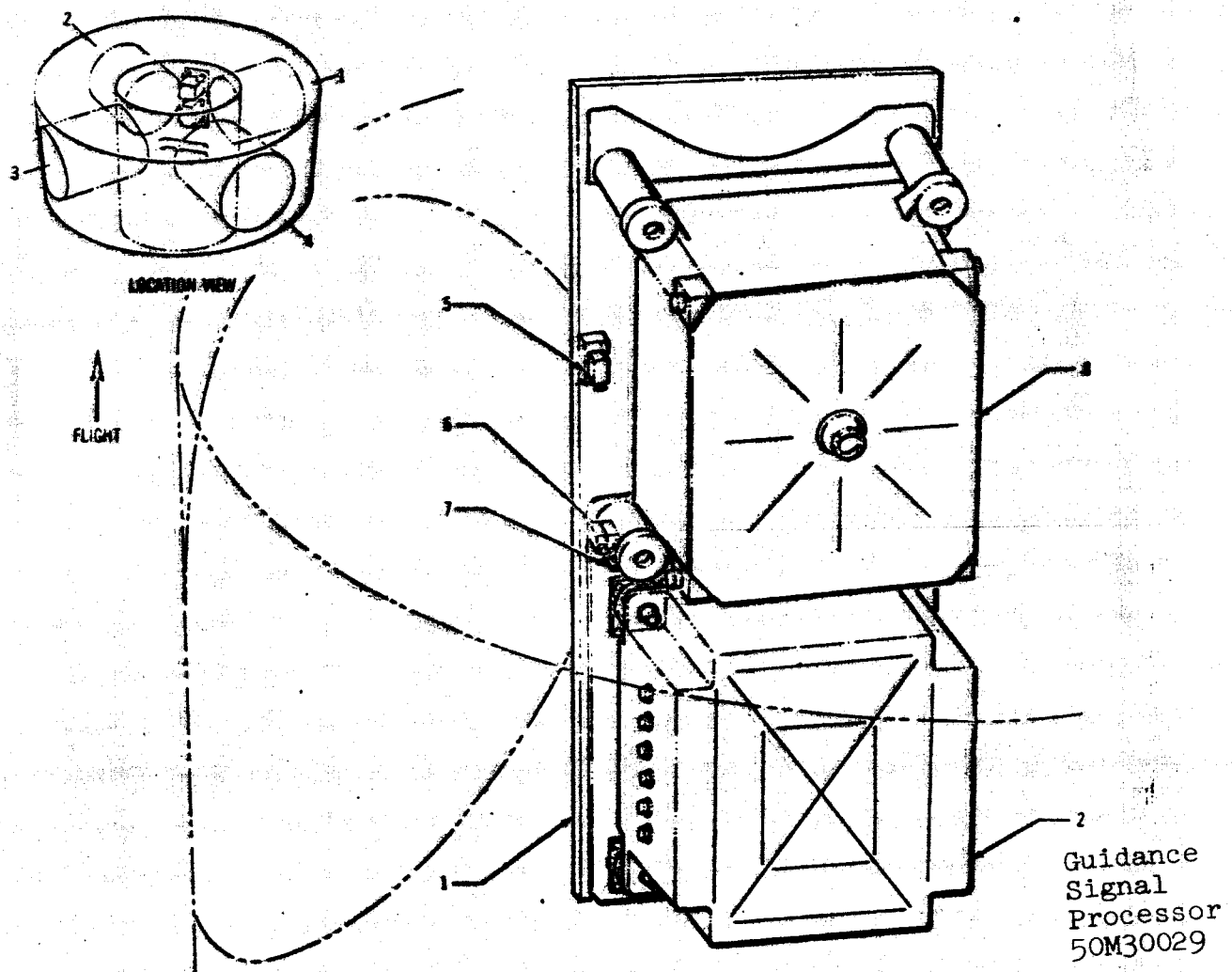
Additional information concerning the 50M30029 Component:

Power - 180 watts

Weight - 92 lb.

Dimensions - 18.7 x 18.6 x 9 in. (3,130 cu. in.)

This component is essentially the input/output unit for the guidance computer.



Six failures were reported on Inspection Reports.

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DATA SHEET	
Nomenclature: Guidance Signal Processor	
Drawing Numbers: 50M32000	Vendor: IBM
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 5,000 hr.	
Failure Rate: $1,268 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 788.7
Number of Components this Data Represents: 8	Total Hours of Operation: 2366.0
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>3 and 15 g for 3 min.</u>	
Altitude: <u>170,000 ft. at 50°C</u>	
Radio Interference:	
Salt Spray: <u>3% saline at 25°C for 48 hr.</u>	
Shock:	
High Temperature: <u>135 to 140°F</u>	
Low Temperature: <u>103 to 106°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>10 and 60°C at 95% for 120 hr.</u>	
Random Noise: <u>4 g at 20 - 300 cps, 12 g at 300 - 2,000 cps</u>	
Sine Wave Method: <u>3.5 g rms at 100-300 cps, 5 g rms at 300 - 2,000 cps; 2.5 g rms at 20-100 cps.</u>	
Vibration:	

Nomenclature: Guidance Signal Processor			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
<u>1</u>	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
<u>1</u>	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization	<u>1</u>	Brake Slips
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-6 through SA-10 Vehicles (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Reports No. 64-373-5125-006,007,009,010,011, date 10 April 1964, 24 April 1964, 1 May 1964, 8 July 1964, 9 July 1964 - IBM			

Additional information concerning the 50M32000 Component:

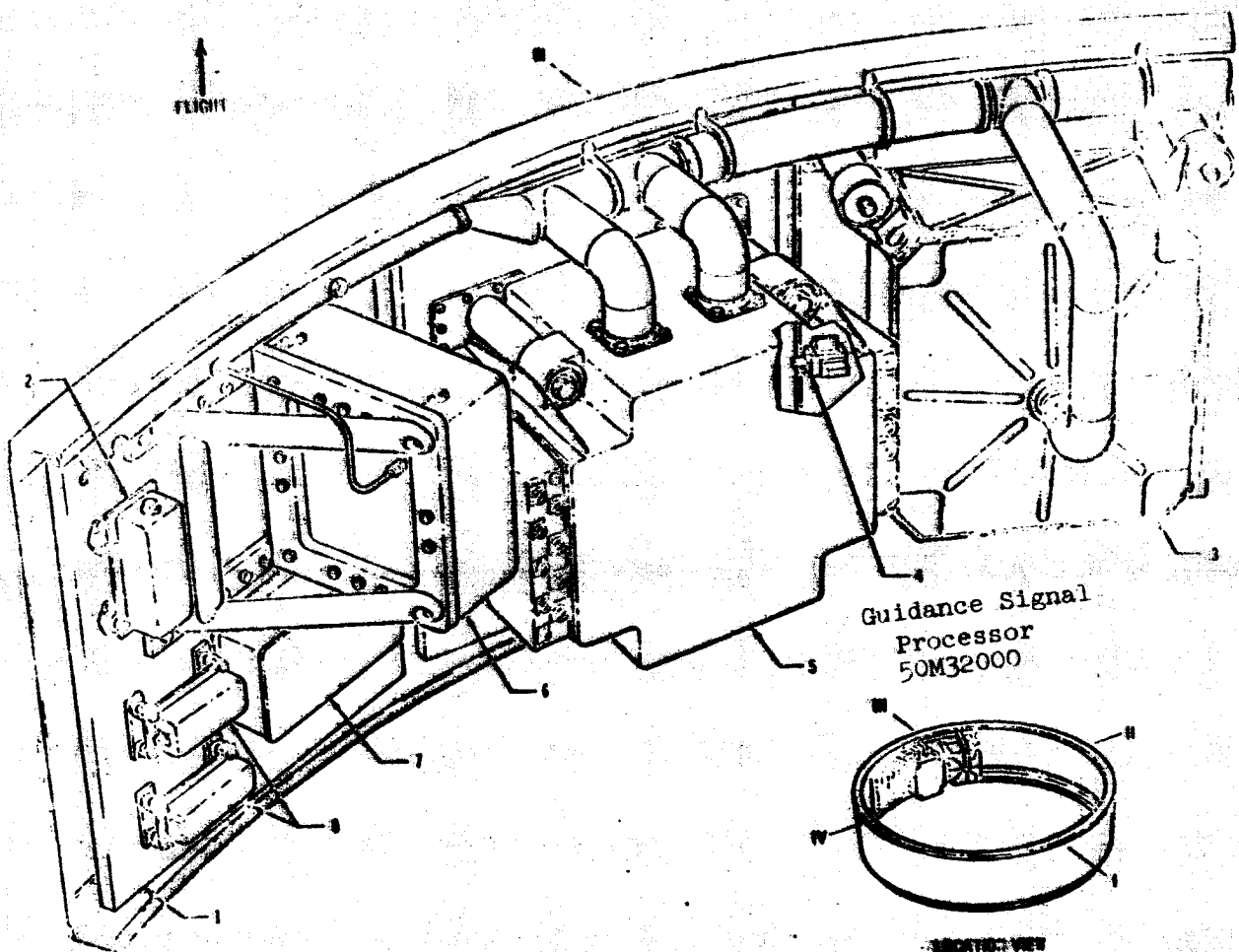
Power Rating - 670 watts

Weight - 110 lb.

Dimensions - 27.5 x 19.1 x 9.87 in. (5, 184 cu. in.)

This component is used on missiles SA-6 through SA-10, and performs the same function as the MSFC-built GSP-24.

Eleven failures were reported on Inspection Reports and one failure was reported on an Unsatisfactory Condition Report.



DATA SHEET	
Nomenclature: Programmer X1	
Drawing Numbers: 50M10280	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 6,000 hr.	
Failure Rate: $2,377 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 421.0
Number of Components this Data Represents: 3	Total Hours of Operation: 1262.0
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Programmer X1			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input;
	Eccentric		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
<u>2</u>	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 and SA-6 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

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Additional information concerning the 50M10280 Component:

The X1 Programmer is a time base device which delivers planned time functions to the control computers, flight sequencers, and the flight sequencer slave component:

Power Rating: 28 watts
Weight: 12.25 lb.
Dimensions: 10 x 9.5 x 6.5 in.

Two failures were reported on Unsatisfactory Condition Reports and one failure was reported on an Inspection Report during incoming functional checkout.

DATA SHEET

Nomenclature: Programmer P1

Drawing Numbers: 50M10283

Vendor: Not available

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: 17,857 $\times 10^{-6}$ /hr.

MTBF (in hours): 56.0

Number of Components
this Data Represents: 2

Total Hours of Operation: 78.5

Number of
Failures Reported: 0

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available

Acceleration:

Altitude:

Radio Interference:

Salt Spray:

Shock:

High Temperature:

Low Temperature:

Ambient Room Temperature:

Thermal Shock:

Shock Impact (Flat Drop):

Leakage Rate:

Humidity:

Random Noise:

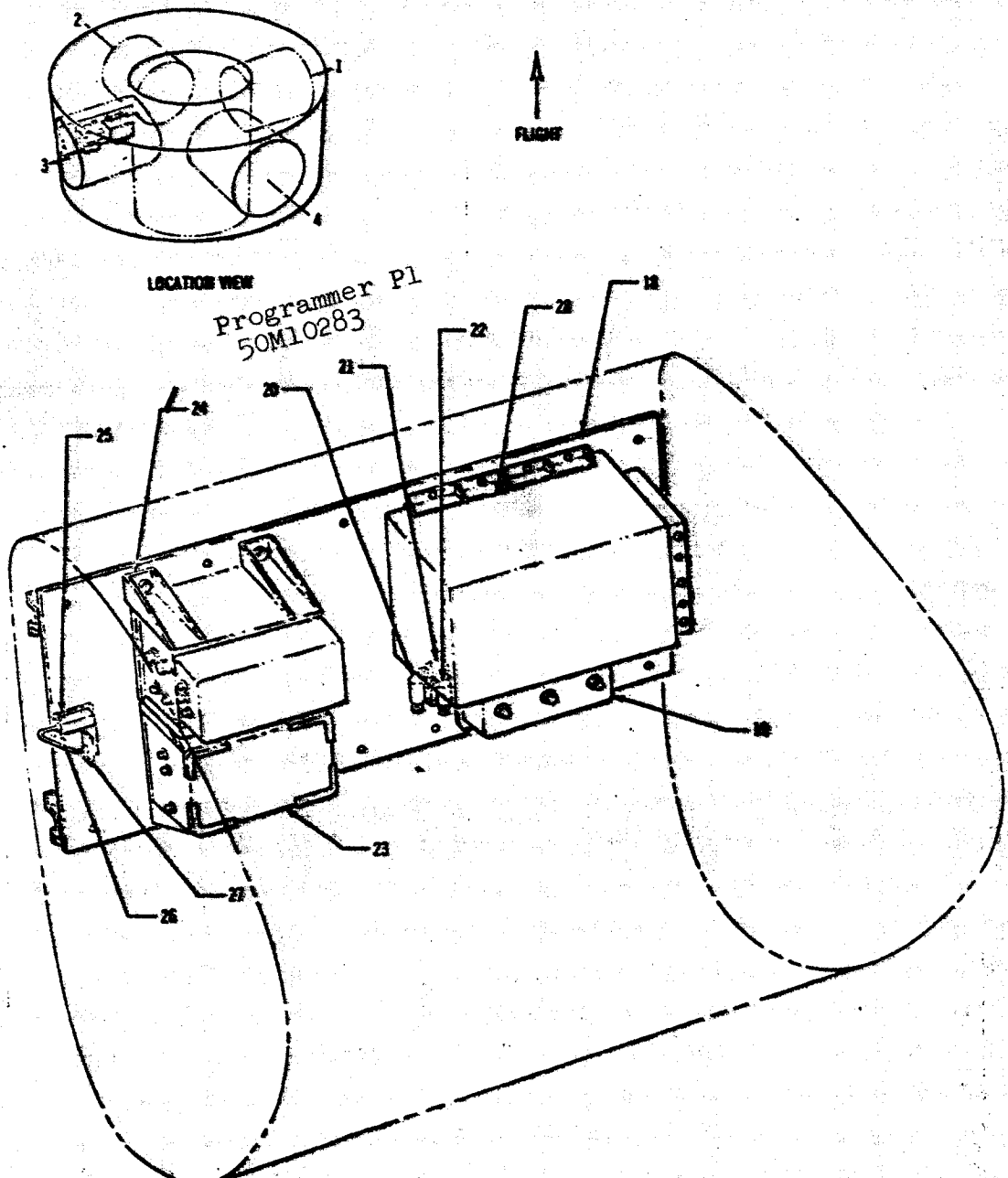
Sine Wave Method:

Vibration:

Nomenclature: Programmer P1			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 Vehicle Only (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10283 Component:

The P1 Programmer is a time base device which delivers planned time functions to the control computers, flight sequencers, and the flight sequencer slave component.



DATA SHEET	
Nomenclature: Program Device	
Drawing Numbers: 8960186	Vendor: Ford Instrument Co.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100,000 cycles	
Failure Rate: $20 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 47,663
Number of Components this Data Represents: 5	Total Cycles of Operation: 190,655*
Number of Failures Reported: 4	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	
* Minimum operation. Serial No. SNJ-156-0 not shown in cycle logs.	

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	4	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: <u>Tape tension</u> <u>too lax to initiate</u> <u>microswitch: (2)</u> <u>Fails to give zero</u> <u>indication: (2)</u>
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: Not indicated (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 8960186 Component:

The Program Device is a time base device which delivers planned time functions to the control computers, flight sequencers, and the flight sequencer slave component.

Three failures were reported on Inspection Reports; one was reported on an Unsatisfactory Condition Report.

DATA SHEET	
Nomenclature: AN/DRW-13 Command Destruct Receiver	
Drawing Numbers: 8968388** , M 50C10418** Saturn I Vehicle	Vendor: Motorola Location: S-I Stage and S-IV Stage
Estimated Design Life: 200 hr.	
Failure Rate: 2,395 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 44 Number of Failures Reported: 6	MTBF (in hours): 417.5 Total Hours of Operation: 2505.5 * Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>3 mutually perpendicular axes 50 g</u>	
Altitude: <u>Maximum altitude unlimited</u>	
Radio Interferences:	
Salt Spray: <u>5% solution 48 hr.</u>	
Shock: <u>5.5 milliseconds 18 shocks at 50 g</u>	
High Temperature: <u>71°C</u>	
Low Temperature: <u>54°C</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop): <u>4 in.</u>	
Leakage Rate:	
Humidity: <u>6 hr. - 50°C 95% (For a total of 240 hr.)</u> <u>16 hr. - 38°C 85%</u>	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20 to 2,000 cycles at 20 g peak for 20 min.</u>	

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- * Minimum operating time. Following serial numbers are not shown in time logs: 160, 145, 174, 164, 366, 368.
- ** Part No. difference is change from old numbering system to new.

Nomenclature: AN/DRW-13 Command Receiver			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy <u>1</u> None <u>4</u> Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: *SA-1 through SA-10 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Astrionics Division MSFC/NASA (no date) Title "Check-out Procedure & Test Record for AN/DRW-13"			

* S-I stage, SA-1 through SA-10; S-IV stage, SA-5 through SA-10

Additional information concerning the 50M10418 Component:

The command destruct receiver, upon receipt of a coded signal from the ground, provides the output signal that actuates the arming and flight termination systems. The unit is a solid-state UHF FM receiver, consisting of a cavity-type preselector and IF section, decoder-driver section, and decoder section, all in one case. The decoder section contains ten channels, and series combinations of the ten channels provide a capability of six simultaneous output signals.

(For S-IV STAGG)

1. Vendor - GFE Part No. AN/DRW-13
2. Location - Forward interstage assembly, beside the access door
3. Service - Electrical
4. Operating Temperature - 65°F to 200°F
5. Electrical Characteristics - Power requirements:
 - a. 28 volts dc
 - b. 18 volts dc (unregulated)
 - c. 18 volts dc (regulated)
 - d. 6 volts dc
6. Weight - 3 lbs. max.
7. Dimensions - 2.828 x 5.993 x 3.07 in. (58 cu. in.)

Four failures were reported on Unsatisfactory Condition Reports, two were reported on Inspection Reports.

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Three of the four "out of specs" were sensitivity complaints:

- 1 - There was a change in sensitivity.
- 2 - Threshold sensitivity would not meet specs.
- 3 - Receiver sensitivity did not meet procedural requirements.

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SUMMARY SHEET

Nomenclature: ST-90S Stabilized Platform

Drawing Numbers: 50M21173,
8970195

Vendor: Sperry Farragut

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 300 hr.

Failure Rate: $748 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 1336.5

Total Number of Components
this Data Represents 7

Total Hours of Operation:
1336.5

Total Number of
Failures Reported 1

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: ST-90S Stabilized Platform			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-6 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: ST-90S Stabilized Platform	
Drawing Numbers: 50M21173	Vendor: Sperry Farragut
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 300 hr.	
Failure Rate: $1,883 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 531.3
Number of Components this Data Represents: 2	Total Hours of Operation: 531.3
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature: <u>25°C</u>	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>50%</u>	
Random Noise:	
Sine Wave Method:	
Vibration: <u>1.5 g random</u>	

Nomenclature: ST-90S Stabilized Platform			
FREQUENCY OF OCCURRENCE		FREQUENCY OF OCCURRENCE	
FAILURE INDICATIONS		FAILURE INDICATIONS	
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-5, SA-6 Vehicle (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M21173, 8970195
Component:

The ST-90S Stabilized Platform performs four basic functions:

1. It establishes a set of inertially stabilized navigation coordinates.
2. It measures vehicle attitude deviations about the navigation coordinates, and generates voltage analogue of the angular deviations and supplies these guidance parameters to the guidance and control system for vehicle attitude control.
3. It measures vehicle acceleration along each of the X, Y, and Z navigation coordinates and supplies an analogue of these parameters to the guidance and control system for the navigation function.
4. It earth-fixes the navigation coordinate system until vehicle lift-off, thereby establishing the zero point reference for the guidance and navigation functions.

Power Rating: 100 watts

Weight: 320 lb.

Dimensions: 3 ft. diameter sphere

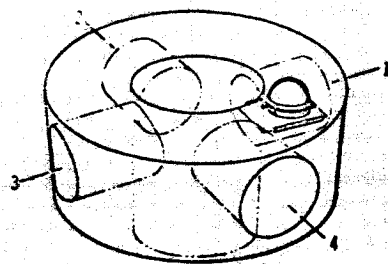
One failure was reported on an Inspection Report.

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DATA SHEET	
Nomenclature: ST-90S Stabilized Platform	
Drawing Numbers: 8970195	Vendor: Sperry Farragut
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 300 hr.	
Failure Rate: $1,721 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 581.0
Number of Components this Data Represents: 5	Total Hours of Operation: 805.2
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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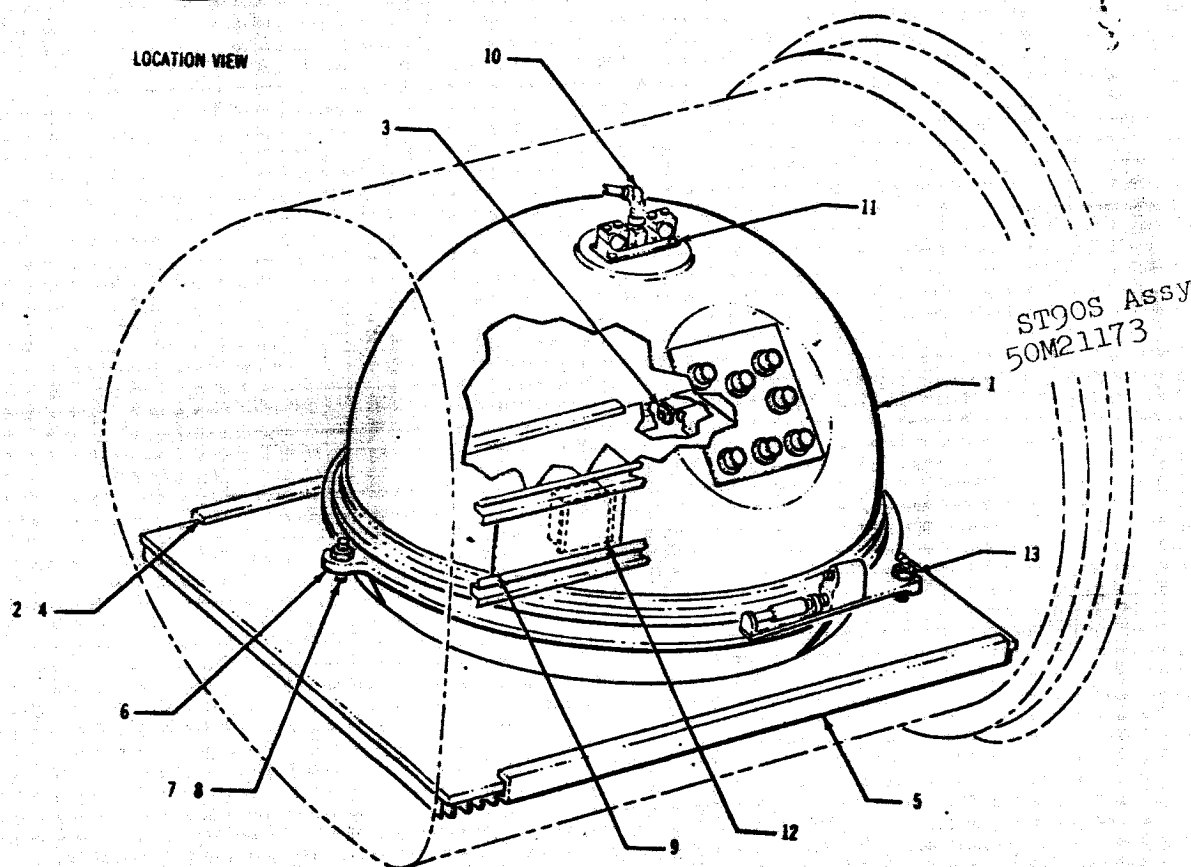
Nomenclature: ST-90S Stabilized Platform			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-4 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			



LOCATION VIEW



FLIGHT



INSTRUMENT UNIT GROUP ASSEMBLY, TUBE NO. 1
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SUMMARY SHEET

Nomenclature: ST-124 Inertial Platform Assy

Drawing Numbers: 50M22001,
10601562

Vendor: Bendix

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: $820 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 1219.4

Total Number of Components
this Data Represents 9

Total Hours of Operation:
3658.1

Total Number of
Failures Reported 3

Vehicle Equipment: X
Ground Equipment:

Nomenclature: ST-124 Inertial Platform Assy

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
<u>1</u>	Oscillation/Fluctuation		Reported as Burned Parts
<u>1</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
<u>1</u>	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 Vehicles (less flight data)

DATA SHEET	
Nomenclature: ST-124 Inertial Platform Assy	
Drawing Numbers: 50M22001	Vendor: Bendix
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 317 x 10 ⁻⁶ /hr.	MTBF (in hours): 3156.9
Number of Components this Data Represents: 7	Total Hours of Operation: 3156.9
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude: <u>3.5 x 10⁻⁵ Atmosphere</u>	
Radio Interference: <u>Data not available</u>	
Salt Spray:	
Shock:	
High Temperature: <u>90°F</u>	
Low Temperature: <u>-35°F</u>	
Ambient Room Temperature: <u>75°F</u>	
Thermal Shock: <u>75 to -35°F</u>	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>3 to 2,000 cps</u>	
Sine Wave Method:	
Vibration: <u>Data not available</u>	

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Nomenclature: ST-124 Inertial Platform Assy			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Excessive		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Instrumentation and Vibration Data, Sled Run 9-1A, 30 April 1964 Air Force Missile Development Center USAF.			

DATA SHEET	
Nomenclature: ST-124 Inertial Platform Assy	
Drawing Numbers: 10601562	Vendor: Bendix
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 3,992 x 10 ⁻⁶ /hr.	MTBF (in hours): 250.6
Number of Components this Data Represents: 2	Total Hours of Operation: 501.2
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude: <u>3.5 x 10⁻⁵ Atmosphere</u>	
Radio Interference: <u>Data not available</u>	
Salt Spray:	
Shock:	
High Temperature: <u>90°F</u>	
Low Temperature: <u>-35°F</u>	
Ambient Room Temperature: <u>75 to -35°F</u>	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>3 to 2,000 cps</u>	
Sine Wave Method:	
Vibration:	

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Nomenclature: ST-124 Inertial Platform Assy			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (Not flown until SA-5)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Instrumentation and Vibration Data, Sled Run 9-1A, 30 April 1964 Air Force Missile Development Center USAF.			

Additional information concerning the 50M22001, 10601562
Component:

The Inertial Platform Assembly performs four basic functions:

1. It establishes a set of inertially stabilized navigation coordinates.
2. It measures vehicle attitude deviations about the navigation coordinates and generates voltage analogue of the angular deviations and supplies these guidance parameters to the guidance and control system for vehicle attitude control.
3. It measures vehicle acceleration along each of the X, Y, and Z navigation coordinates and supplies an analogue of these parameters to the guidance and control system for the navigation function.
4. Earth fixes the navigation coordinate system until vehicle lift-off, thereby establishing the zero point reference for the guidance and navigation functions.

Weight: 107 lb

Dimensions: 22 in. diameter

Three failures were reported on Inspection Reports.

SUMMARY SHEET

Nomenclature: Control Rate Gyro

Drawing Numbers: 50M31125,
10422022

Vendor: Honeywell

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: $3,691 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 270.9

Total Number of Components
this Data Represents 19

Total Hours of Operation:
1083.4

Total Number of
Failures Reported 4

Vehicle Equipment: X
Ground Equipment:

Nomenclature: Control Rate Gyro			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error <u>1</u> Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None <u>1</u> Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction	<u>1</u>	Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Control Rate Gyro	
Drawing Numbers: 50M31125	Vendor: Honeywell
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 17,953 x 10 ⁻⁶ /hr.	MTBF (in hours): 55.7
Number of Components this Data Represents: 4	Total Hours of Operation: 111.3
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>10 g for 18 minutes (3 minutes each for 3 mutual perpendicular axes)</u>	
Altitude: <u>600,000 ft. for 2 min.</u>	
Radio Interference:	
Salt Spray: <u>5% salt solution for 50 hr.</u>	
Shock: <u>100 g for 11 milliseconds, 1/2 sine shock pulse 3 times in each direction of 3 Orthogonal Axes.</u>	
High Temperature: <u>160°F for 48 hr.</u>	
Low Temperature: <u>2°F</u>	
Ambient Room Temperature: <u>60°F to 95°F</u>	Relative Humidity <u>90% or less</u>
Thermal Shock: <u>160 and 2°F for 6 hr. each</u>	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>95% at 160°F for 1.5 hr.</u>	
Random Noise:	
Sine Wave Method:	
Vibration: <u>10 - 40 cps at 20 in. D.A. 40 - 2,000 at 17 g peak</u> <u>10-2,000 to 10 cps for 15 min. 1 full sweep in each 3 mutual perpendicular axes.</u>	

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Nomenclature: Control Rate Gyro			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
<u>1</u>			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-6 through SA-9 (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Minneapolis-Honeywell Report No. M-H-EPA 20820, Dec. 28, 1962.			

DATA SHEET

Nomenclature: Control Rate Gyro

Drawing Numbers: 10422022

Vendor: Honeywell

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: 2,057 x 10⁻⁶/hr.

MTBF (in hours): 486.1

Number of Components
this Data Represents: 15

Total Hours of Operation: 972.1

Number of
Failures Reported: 2

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:

Acceleration: 10 g for 18 minutes (3 minutes each for
3 mutually perpendicular axes)

Altitude: 600,000 ft. for 2 minutes

Radio Interference:

Salt Spray: 5% salt solution for 50 hr.

Shock: 100 g for 11 milliseconds, 1/2 sine shock pulse
3 times in each direction of 3 Orthogonal Axes.

High Temperature: 160°F for 48 hr.

Low Temperature: 2°F

Ambient Room Temperature: 60°F to 95°F, Relative Humidity
90% or less

Thermal Shock: 160°F and 2°F for 6 hr. each

Shock Impact (Flat Drop):

Leakage Rate:

Humidity: 95% at 160°F for 1.5 hr.

Random Noise:

Sine Wave Method:

Vibration: 10-40 cps at 0.20 inch D.A. 40-2,000 at 17 g

peak
10 to 2,000 to 10 cps for 15 min. 1 full sweep
in each of 3 mutually perpendicular axes

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Nomenclature: Control Rate Gyro			
FREQUENCY OF OCCURRENCE		FREQUENCY OF OCCURRENCE	
FAILURE INDICATIONS		FAILURE INDICATIONS	
<u>1</u>	Impedance:	<u>1</u>	Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
Out of Specs	Other:		
Out of Synchronization			
Over Modulation			
Overspeed			
Regulation			
Shorted			
Reverses Polarity			
Reverses Direction			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-2 through SA-10 Vehicles (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Minneapolis-Honeywell Report No. M-H-EPA 20820, Dec. 28, 1962.			

Additional information concerning the 50M31125, 10422022
Component:

The Control Rate Gyro senses the rate of angular movement in the vehicle's pitch, yaw, and roll planes. Gives rate stabilization to vehicle control systems.

Power Rating: 15 watts

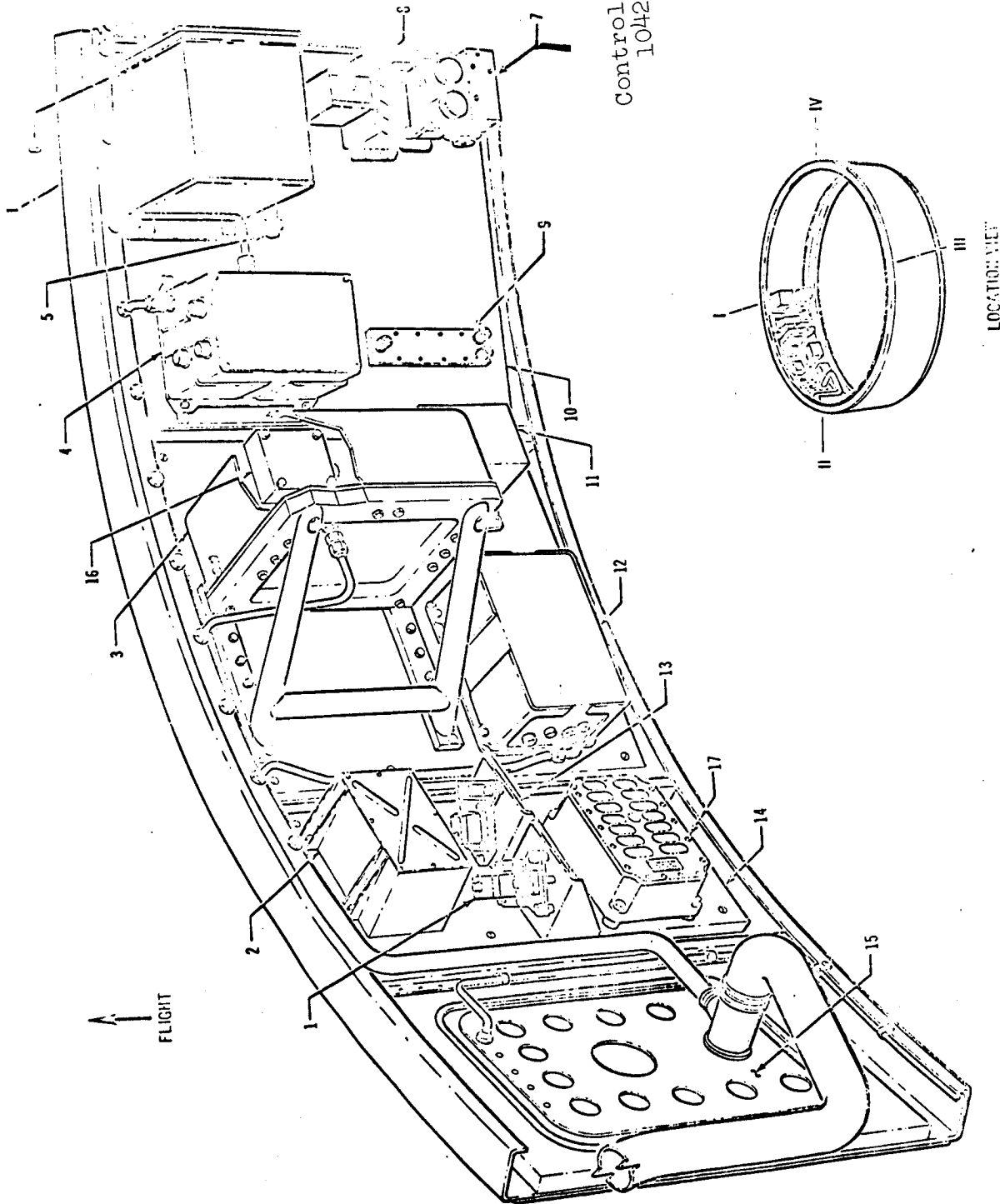
Weight: 10.5 lb.

Dimensions: 7 x 7 x 3.5 in.

Three failures were reported on Unsatisfactory Condition Reports and 1 failure was reported on an Inspection Report.

Note: The numbers 50M31125 and 50C31125 represent the same part; the "M" represents a Marshall part Number, and the "C" represents a Chrysler part Number.

Control Rate Gyro
10422022



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SUMMARY SHEET

Nomenclature: Control Accelerometer

Drawing Numbers: 50M31126,
50M31127

Vendor: Statham Instrument Co.

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life:

Failure Rate: 1851 $\times 10^{-6}$ /hr.

MTBF (in hours): 540.1

**Total Number of Components
this Data Represents** 6

Total Hours of Operation:
748.0

**Total Number of
Failures Reported** 0

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: Control Accelerometer

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)

DATA SHEET	
Nomenclature: Control Accelerometer - Yaw	
Drawing Numbers: 50M31127 Saturn I Vehicle	Vendor: Statham Instrument Co. Location: Instrument Unit
Estimated Design Life:	
Failure Rate: 4,666 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 3 Number of Failures Reported: 0	MTBF (in hours): 214.3 Total Hours of Operation: 296.8 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>10 g - 3 perpendicular planes</u>	
Altitude: <u>1 x 10⁻⁵ mm of Hg for 30 min.</u>	
Radio Interference: <u>Reference: MIL-I-6181 D</u>	
Salt Spray: <u>5% solution for 48 hr.</u>	
Shock: <u>1/2 sine at 50 g for 4 milliseconds</u>	
High Temperature: <u>71°C</u>	
Low Temperature: <u>-29°C</u>	
Ambient Room Temperature:	
Thermal Shock: <u>71°C for 2 hr.; in 2 min. down to -29°C for 2 hr.</u>	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>27 to 71°C humidity increased to 95% in 0.4 hr. maintained for 1.2 hr. decreased to 25°C in 3.2 hr.</u>	
Random Noise:	
Sine Wave Method:	
Vibration: See page 7	

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Nomenclature: Control Accelerometer - Yaw

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Eccentric		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less
flight data)

COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Wyle Laboratories
Report No. E-5013-11-1, 5-14-64

DATA SHEET	
Nomenclature: Control Accelerometer - Pitch	
Drawing Numbers: 50M31126	Vendor: Statham Instrument Co.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life:	
Failure Rate: 3,069 x 10 ⁻⁶ /hr.	MTBF (in hours): 325.8
Number of Components this Data Represents: 3	Total Hours of Operation: 451.2
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as Page 3, I.7.4	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Control Accelerometer - Pitch			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Flows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M31127 component:

This component measures acceleration from minus 1 g to plus 1 g.

NOTE:

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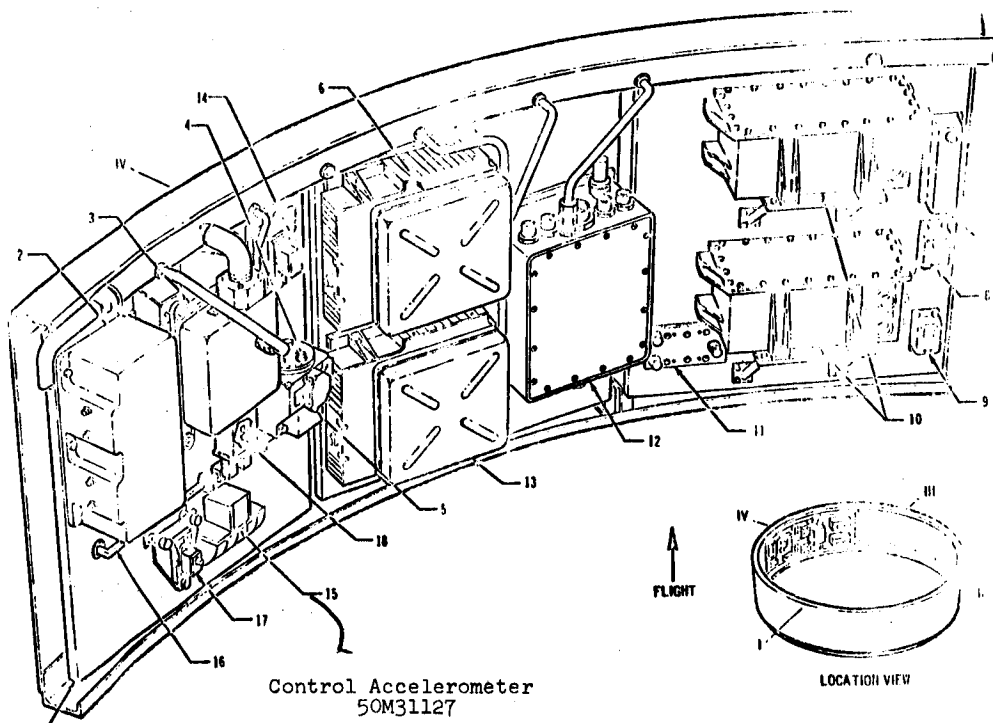
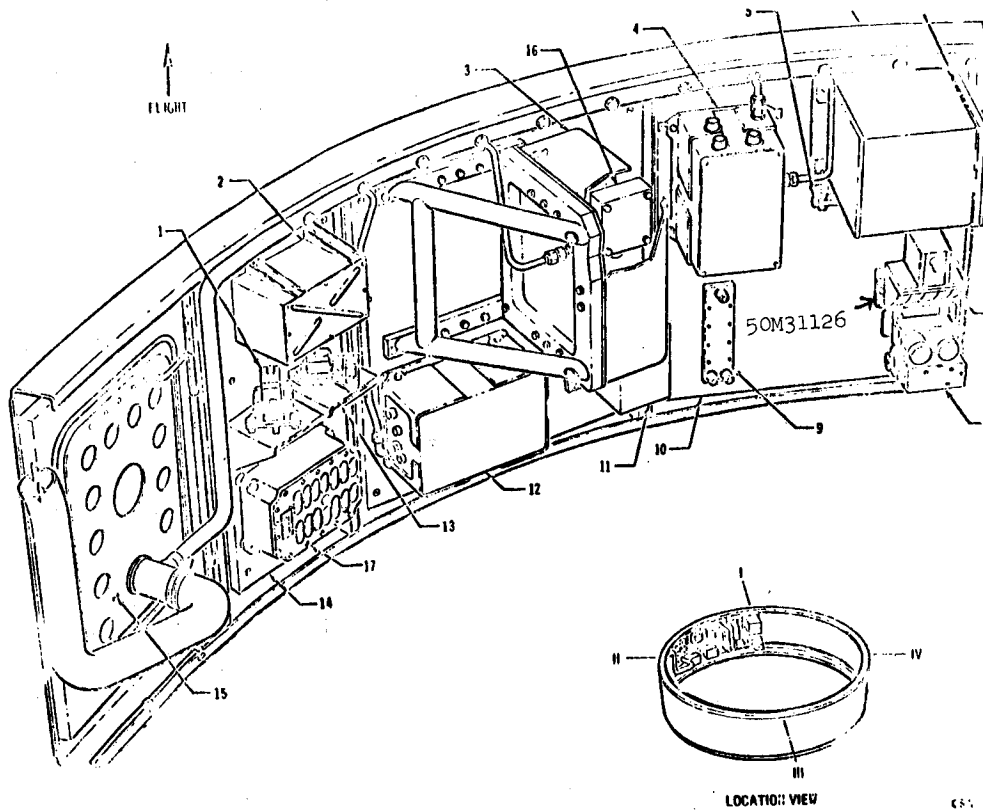
Vibration:

Y and Z axes 20-2000-CPS-4-sec. 21-G RMS-0.23-G²/CPS

Y and Z axes 20-2000-CPS-8-sec. 12-G RMS-0.077-G²/CPS

X axis 100-2000-CPS-4-sec. 21-GRMS 0.23 G²/CPS

X axis 100-2000-CPS-180-sec. 12-GRMS 0.077 G²/CPS



SUMMARY SHEET

Nomenclature: XO-4 FM/FM/PAM Transmitter

Drawing Numbers: ¹

Vendor: Vector, Motorola

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: 6,902 x 10⁻⁶/hr.

MTBF (in hours): 144.8

Total Number of Components
this Data Represents 36

Total Hours of Operation:
2,173.5*

Total Number of
Failures Reported 15

Vehicle Equipment: X
Ground Equipment:

¹ 50M10029, 50M10032, 50M10192,
50M10031, 50M10030, 50M10033,
50M10189, 8968402, 8968404,
8968406, 8968403, 8968405,
8968407

* Minimum operating time. Serial
No. P0880 not in Time Logs.

Nomenclature: XO-4 FM/FM/PAM Transmitter

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
<u>2</u>	Erratic		Inoperative
	Excessive Null	<u>1</u>	Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal	<u>1</u>	Blowers:
	High		Inoperative
<u>2</u>	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
<u>1</u>	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>5</u>	Out of Specs	<u>1</u>	Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-1 through SA-5 vehicles (less flight data)

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DATA SHEET	
Nomenclature: Telemetry XO-4 FM/FM/PAM Transmitter	
Drawing Numbers: 8968402, 8968404, 8968406, 8968403, 8968405, 8968407** Saturn I Vehicle	Vendor: Vector Mfg. Co. Location: Instrument Unit
Estimated Design Life: 1,000 hr. minimum	
Failure Rate: 5,226 $\times 10^{-6}$ /hr. Number of Components this Data Represents: 14 Number of Failures Reported: 3	MTBF (in hours): 191.3 Total Hours of Operation: 574.2* Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

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* Minimum operating time. Sec No. P0880 not in Time Logs.

** Drawing number differences are only to identify the TM links

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Nomenclature: Telemetry XO-4 FM/FM/PAM Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
<u>1</u>	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 and SA-2 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: XO-4 FM/FM/PAM Transmitter	
Drawing Numbers: 50M10029, 50M10032, 50M10192, 50M10031, 50M10030, 50M10033, 50M10189* Saturn I Vehicle	Vendor: Vector, Motorola Location: Instrument Unit
Estimated Design Life: 1,000 hr	
Failure Rate: 7,009 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 22 Number of Failures Reported: 12	MTBF (in hours): 142.6 Total Hours of Operation: 1,712.4 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
<p>Acceleration:</p> <p>Altitude:</p> <p>Radio Interference:</p> <p>Salt Spray:</p> <p>Shock:</p> <p>High Temperature:</p> <p>Low Temperature:</p> <p>Ambient Room Temperature:</p> <p>Thermal Shock:</p> <p>Shock Impact (Flat Drop):</p> <p>Leakage Rate:</p> <p>Humidity:</p> <p>Random Noise:</p> <p>Sine Wave Method:</p> <p>Vibration:</p>	

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* Drawing number differences are only to
identify TM links.

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Nomenclature: XO-4 FM/FM/PAM Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal	<u>1</u>	Pressure: High Low None Input: Inoperative Fuses: Blows/Blown
<u>2</u>	High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation	<u>1</u>	Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative
<u>5</u>	Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction	<u>1</u>	Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 through SA-5 Vehicles (less flight data) PN 50M10189, 50M10192 SA-5 only.			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: XO-4 FM/FM/PAM Transmitter	
Drawing Numbers: 50M10029, 50M10032, 50M10192, 50M10031, 50M10030, 50M10033, 50M10189* Saturn I Vehicle	Vendor: Vector, Motorola Location: Instrument Unit
Estimated Design Life: 1,000 hr	
Failure Rate: 7,009 $\times 10^{-6}$ /hr. Number of Components this Data Represents: 22 Number of Failures Reported: 12	MTBF (in hours): 142.6 Total Hours of Operation: 1,712.4 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

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* Drawing number differences are only to
identify TM links.

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Nomenclature: XO-4 FM/FM/PAM Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
<u>2</u>	Erratic		Inoperative
	Excessive Null	<u>1</u>	Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal	<u>1</u>	Blowers:
<u>2</u>	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
<u>5</u>	Oscillation/Fluctuation	<u>1</u>	Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 through SA-5 Vehicles (less flight data) PN 50M10189, 50M10192 SA-5 only.			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

Additional information concerning the 8968402, 8968404, 8968406, 8968403, 8968405, 8968407 component:

The XO-4 Telemetry Transmitter transmits vehicle instrument readings and environmental conditions to remote ground stations by means of SS/FM and PAM/FM/FM operation.

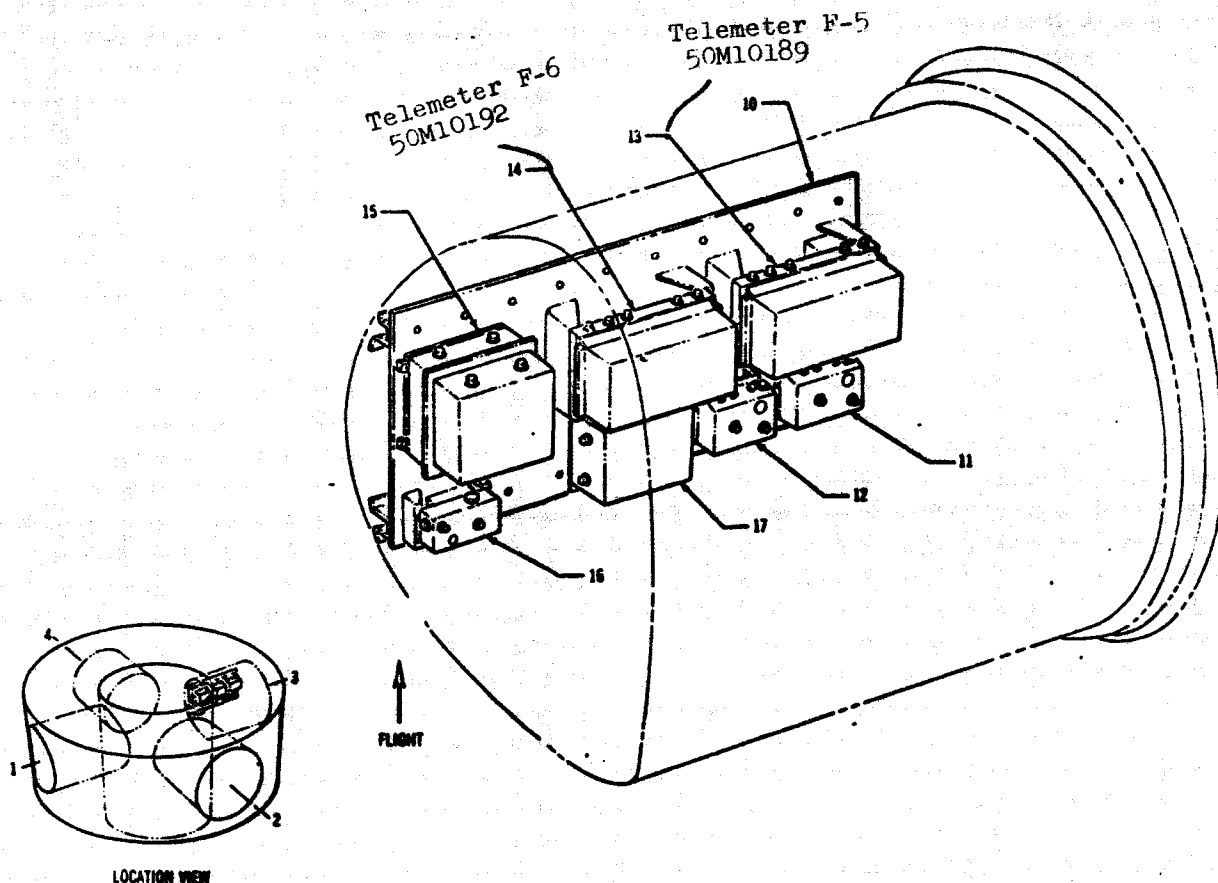
Power Rating: 6 amps

Weight: 29 lb

Dimensions: 12 x 8.5 x 8.75 in.

NOTE: This component uses conventional vacuum tubes.

Eight failures were reported on Inspection Reports and seven failures were reported on Unsatisfactory Condition Reports.



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SUMMARY SHEET

Nomenclature: Telemetry Multiplexer XO-6 PAM/FM/FM 270 Channel

Drawing Numbers: 50M10489,
50M10380, 50M10660, 50M10662,
50M10028, 50M10472, 50M10473¹

Saturn I Vehicle

Vendor: NASA/MSFC Astrionics
Electro Mechanical Research
International Data Systems

Location: S-1 Stage

Estimated Design Life: 1,000 hr

Failure Rate: 10,152 x 10⁻⁶/hr.

Total Number of Components
this Data Represents 33

Total Number of
Failures Reported 51

MTBF (in hours): 98.5

Total Hours of Operation:
5022.4 *

Vehicle Equipment: X
Ground Equipment:

¹ Additional drawing numbers:
50M10152, 50M10154, 50M1004

* Minimum operating time.
PN 50M10473, Serial No. 101, not
shown in Time Logs.

Nomenclature: Telemetry Multiplexer XO-6 PAM/FM/FM 270 Channel

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
<u>1</u>	Low		High
	High		Low
	Output:		None
	Distorted	<u>4</u>	Input:
	Erratic		Inoperative
	Excessive Null	<u>1</u>	Fuses:
	Excessive Roll		Blows/Blown
<u>7</u>	Unwanted Signal		Blowers:
	High		Inoperative
<u>2</u>	In Error		Intermittent
<u>5</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>9</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
<u>2</u>	None		Miscellaneous:
<u>2</u>	Oscillation/Fluctuation		Reported as Burned Parts
<u>12</u>	Out of Specs		Other:
<u>2</u>	Out of Synchronization	<u>1</u>	Impedance, None
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
<u>1</u>	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-3 through SA-9 Vehicles (less flight data)

DATA SHEET	
Nomenclature: XO-6 PAM/FM/FM 270 Channel	
Drawing Numbers: 50M10489	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 4,255 $\times 10^{-6}$ /hr.	MTBF (in hours): 235.0
Number of Components this Data Represents: 2	Total Hours of Operation: 326.0
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: XO-6 PAM/FM/FM 270 Channel

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: X0-6 PAM/FM/FM 270 Channel	
Drawing Numbers: 50M10380 Saturn I Vehicle	Vendor: Electro Mechanical Research Location: S-I Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 5,133 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 7 Number of Failures Reported: 4	MTBF (in hours): 194.8 Total Hours of Operation: 779.4 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: X0-6 PAM/FM/FM 270 Channel			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Impedance:	<u>1</u>	Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-7 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: XO-6 PAM/FM/FM 270 Channel	
Drawing Numbers: 50M10660, 50M10662*	Vendor: NASA/MSFC Astrionics AVCO
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 8488 x 10 ⁻⁶ /hr.	MTBF (in hours): 117.8
Number of Components this Data Represents: 10	Total Hours of Operation: 2356.5
Number of Failures Reported: 20	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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 * Drawing number differences only to identify
 the TM links

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Nomenclature: XO-6 PAM/FM/FM 270 Channel			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
<u>1</u>	Low		High
	High		Low
	Output:		None
	Distorted	<u>1</u>	Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
<u>3</u>	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>3</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
<u>1</u>	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>6</u>	Out of Specs		Other:
<u>2</u>	Out of Synchronization	<u>1</u>	Impedance,
	Over Modulation		None
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-7 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: XO-6 PAM/FM/FM 270 Channel	
Drawing Numbers: 50M10028 Saturn I Vehicle	Vendor: International Data Systems Incorporated Location: S-I Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 24,450 $\times 10^{-6}$ /hr. Number of Components this Data Represents: 4 Number of Failures Reported: 10	MTBF (in hours): 40.9 Total Hours of Operation: 408.7* Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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 * Minimum operating time. Serial No. 9
 not shown in Time Logs.

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Nomenclature: XO-6 PAM/FM/FM 270 Channel			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Impedance: Low High	<u>6</u>	Pressure: High Low
<u>1</u>	Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High		None
<u>6</u>	In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: X0-6 PAM/FM/FM 270 Channel	
Drawing Numbers: 50M10472, 50M10473*	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 13,966 x 10 ⁻⁶ /hr.	MTBF (in hours): 71.6
Number of Components this Data Represents: 4	Total Hours of Operation: 645.0
Number of Failures Reported: 9	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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* Drawing number difference only to identify the TM links.

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Nomenclature: XO-6 PAM/FM/FM 270 Channel			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic	<u>1</u>	Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
<u>2</u>	Unwanted Signal		Blowers:
	High		Inoperative
<u>1</u>	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
<u>1</u>	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>2</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
<u>1</u>	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-6 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: XO-6 PAM/FM/FM 270 Channel	
Drawing Numbers: 50M10152, 50M10154*	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 11,467 $\times 10^{-6}$ /hr.	MTBF (in hours): 87.2
Number of Components this Data Represents: 5	Total Hours of Operation: 436.4
Number of Failures Reported: 5	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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* Drawing number difference only to identify the TM Link.

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Nomenclature: X0-6 PAM/FM/FM 270 Channel

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS																																																					
<div><u>1</u></div> <div><u>2</u></div> <div><u>1</u></div> <tr><td>Impedance:</td><td>Pressure:</td></tr> <tr><td>Low</td><td>High</td></tr> <tr><td>High</td><td>Low</td></tr> <tr><td>Output:</td><td>None</td></tr> <tr><td>Distorted</td><td>Input:</td></tr> <tr><td>Erratic</td><td>Inoperative</td></tr> <tr><td>Excessive Null</td><td>Fuses:</td></tr> <tr><td>Excessive Roll</td><td>Blows/Blown</td></tr> <tr><td>Unwanted Signal</td><td>Blowers:</td></tr> <tr><td>High</td><td>Inoperative</td></tr> <tr><td>In Error</td><td>Intermittent</td></tr> <tr><td>Intermittent</td><td>Mechanical:</td></tr> <tr><td>Loss of Some Voltages</td><td>Pins Shorted</td></tr> <tr><td>Low</td><td>Indicators/ Dials Are In Error</td></tr> <tr><td>Low Sensitivity</td><td>Indicators/ Dials Are In- operative</td></tr> <tr><td>Low Speed</td><td>Lamps:</td></tr> <tr><td>No Lock On (Frequency)</td><td>Will Not Light</td></tr> <tr><td>Noisy</td><td>Stay On</td></tr> <tr><td>None</td><td>Miscellaneous:</td></tr> <tr><td>Oscillation/Fluctuation</td><td>Reported as Burned Parts</td></tr> <tr><td>Out of Specs</td><td>Other:</td></tr> <tr><td>Out of Synchronization</td><td></td></tr> <tr><td>Over Modulation</td><td></td></tr> <tr><td>Overspeed</td><td></td></tr> <tr><td>Regulation</td><td></td></tr> <tr><td>Shorted</td><td></td></tr> <tr><td>Reverses Polarity</td><td></td></tr> <tr><td>Reverses Direction</td><td></td></tr>	Impedance:	Pressure:	Low	High	High	Low	Output:	None	Distorted	Input:	Erratic	Inoperative	Excessive Null	Fuses:	Excessive Roll	Blows/Blown	Unwanted Signal	Blowers:	High	Inoperative	In Error	Intermittent	Intermittent	Mechanical:	Loss of Some Voltages	Pins Shorted	Low	Indicators/ Dials Are In Error	Low Sensitivity	Indicators/ Dials Are In- operative	Low Speed	Lamps:	No Lock On (Frequency)	Will Not Light	Noisy	Stay On	None	Miscellaneous:	Oscillation/Fluctuation	Reported as Burned Parts	Out of Specs	Other:	Out of Synchronization		Over Modulation		Overspeed		Regulation		Shorted		Reverses Polarity		Reverses Direction	
	Impedance:	Pressure:																																																						
	Low	High																																																						
	High	Low																																																						
	Output:	None																																																						
	Distorted	Input:																																																						
	Erratic	Inoperative																																																						
	Excessive Null	Fuses:																																																						
	Excessive Roll	Blows/Blown																																																						
	Unwanted Signal	Blowers:																																																						
	High	Inoperative																																																						
	In Error	Intermittent																																																						
	Intermittent	Mechanical:																																																						
	Loss of Some Voltages	Pins Shorted																																																						
	Low	Indicators/ Dials Are In Error																																																						
	Low Sensitivity	Indicators/ Dials Are In- operative																																																						
	Low Speed	Lamps:																																																						
	No Lock On (Frequency)	Will Not Light																																																						
	Noisy	Stay On																																																						
	None	Miscellaneous:																																																						
	Oscillation/Fluctuation	Reported as Burned Parts																																																						
	Out of Specs	Other:																																																						
	Out of Synchronization																																																							
	Over Modulation																																																							
	Overspeed																																																							
	Regulation																																																							
	Shorted																																																							
	Reverses Polarity																																																							
Reverses Direction																																																								

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-5 Vehicle (less flight data)

COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:

DATA SHEET	
Nomenclature: XO-6 PAM/FM/FM 270 Channel	
Drawing Numbers: 50M10004 Saturn I Vehicle	Vendor: International Data Systems Incorporated Location: S-1 Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 42,918 $\times 10^{-6}$ /hr. Number of Components this Data Represents: 1 Number of Failures Reported: 3	MTBF (in hours): 23.3 Total Hours of Operation: 70.4 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: X0-6 PAM/FM/FM 270 Channel			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
<u>1</u>	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10489, 50M10380, 50M10660, 50M10662, 50M10028, 50M10472, 50M10473, 50M10152, 50M10154, 50M1004 component:

The X0-6 Telemetry Multiplexer transmits vehicle instrument readings and environmental conditions to remote ground stations by means of SS/FM and PAM/FM/FM operation.

Power Rating: 1.1 amp 28 volts
Weight: 22 1/2 lb
Dimensions: 9.25 x 10 x 14.5 in.

NOTE: This component is basically the same as X0-4 but uses transistors in place of vacuum tubes.

Thirty-five failures were reported on Inspection Reports and sixteen were reported on Unsatisfactory Condition Reports.

NOTE: Six failures which are designated as "out of spec" failures on the data sheets for parts 50M10660 and 50M10380 appeared to be the result of sub-carrier oscillator mismating.

SUMMARY SHEET

Nomenclature: XO-7 SS/FM Transmitter

Drawing Numbers: 8968457, 8968458,
50M10160, 50M10162, 50M10194,
50M10673, 50M10680

Vendor: Brown Engineering Co.,
NASA/MSFC Astrionics,
Dynatronics, Inc.,
Ortronix Inc.

Saturn I Vehicle

Location: S-I Stage and
Instrument Unit Section

Estimated Design Life: 1,000 hr.

Failure Rate: 5,980 $\times 10^{-6}$ /hr.

MTBF (in hours): 167.2

Total Number of Components
this Data Represents 47

Total Hours of Operation:
3,678.8

Total Number of
Failures Reported 22

Vehicle Equipment: X
Ground Equipment:

Nomenclature: XO-7 SS/FM Transmitter

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
<u>1</u>	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
<u>1</u>	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
<u>1</u>	Loss of Some Voltages		Pins Shorted
<u>3</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
<u>2</u>	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>12</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-1 through SA-10 Vehicles (less flight data)

DATA SHEET	
Nomenclature: XO-7 SS/FM Transmitter	
Drawing Numbers: 8968457, 8968458 Saturn I Vehicle	Vendor: Ortronix Inc. Location: S-I Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 810 $\times 10^{-6}$ /hr. Number of Components this Data Represents: 17 Number of Failures Reported: 1	MTBF (in hours): 1,234.3 Total Hours of Operation: 1,234.3 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: XO-7 SS/FM Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: XO-7 SS/FM Transmitter	
Drawing Numbers: 50M10160, 50M10162* Saturn I Vehicle	Vendor: NASA/MSFC Astrionics Dynatronics, Ortronix Inc. Location: S-I Stage
Estimated Design Life: 1,000 hr.	
Failure Rate: 7,163 $\times 10^{-6}$ /hr. Number of Components this Data Represents: 20 Number of Failures Reported: 12	MTBF (in hours): 139.6 Total Hours of Operation: 1675.5 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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 * Drawing number difference is only to identify I.8.3
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Nomenclature: XO-7 SS/FM Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
<u>1</u>	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>3</u>	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
<u>1</u>	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>7</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 and SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: XO-7 SS/FM Transmitter	
Drawing Numbers: 50M10194	Vendor: Dynatronics Ortronix Inc.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 7,385 $\times 10^{-6}$ /hr.	MTBF (in hours): 135.4
Number of Components this Data Represents: 5	Total Hours of Operation: 677.1
Number of Failures Reported: 5	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: XO-7 SS/FM Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
<u>1</u>	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
<u>1</u>	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>3</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available			

DATA SHEET	
Nomenclature: X0-7 SS/FM Transmitter	
Drawing Numbers: 50M10673	Vendor: Not Available
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 99009 $\times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 2 Number of Failures Reported: 0	MTBF (in hours): 10.1 Total Hours of Operation: 14.0 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: XO-7 SS/FM Transmitter

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: XO-7 SS/FM Transmitter	
Drawing Numbers: 50M10680	Vendor: Dynatronics Inc., Brown Engineering Co.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 51,282 $\times 10^{-6}$ /hr.	MTBF (in hours): 19.5
Number of Components this Data Represents: 3	Total Hours of Operation: 77.9
Number of Failures Reported: 4	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: XO-7 SS/FM Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
<u>1</u>	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>1</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 8968457, 8968458, 50M10160, 50M10162, 50M10174, 50M10673, 50M10680 component:

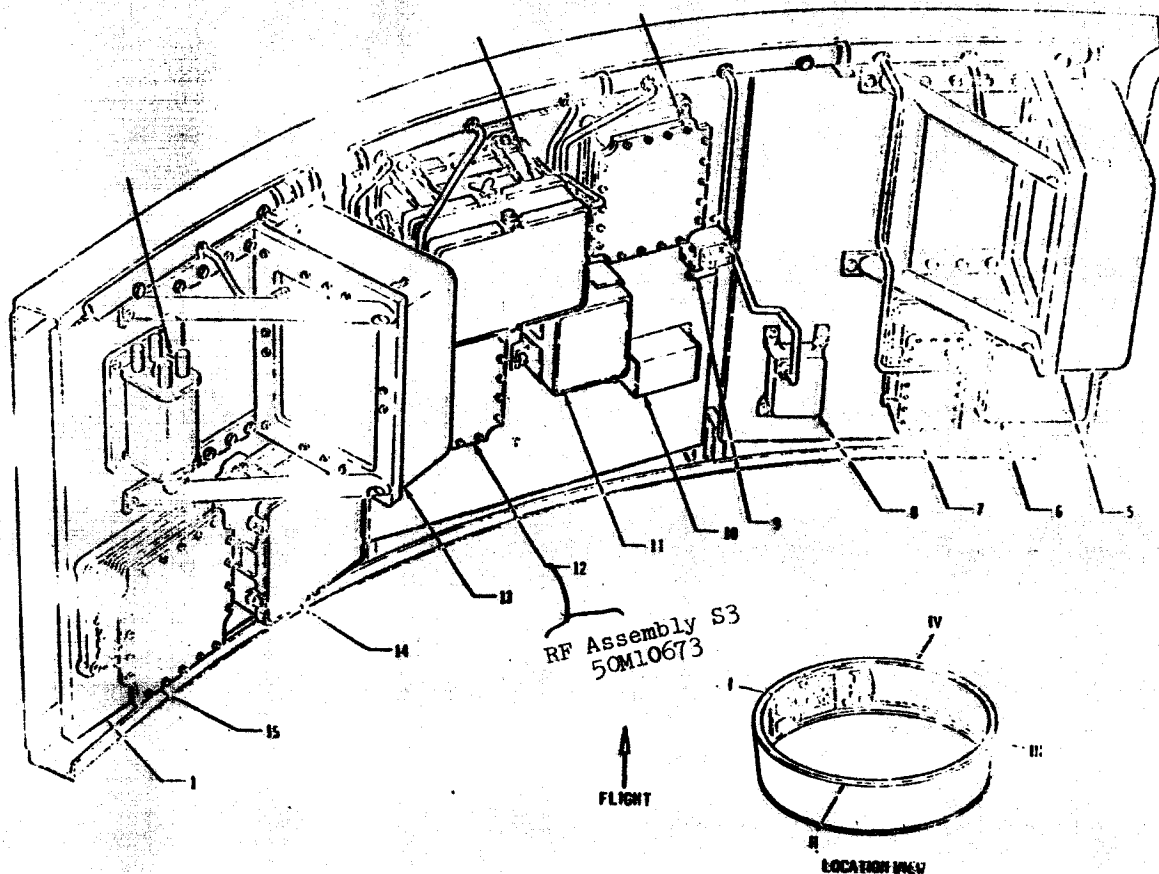
The X0-7 Transmitter transmits vehicle instrument readings and environmental conditions to remote ground stations by means of SS/FM and PAM/FM/FM operation.

Power Rating: 1.5 amp

Weight: 22 lb

Dimensions: 11.80 x 11.55 x 8.5 in.

Fifteen failures were reported on Inspection Reports and seven were reported on Unsatisfactory Condition Reports.



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DATA SHEET	
Nomenclature: Telemetry X0-10 Transmitter PAM/FM 30 Channel.	
Drawing Numbers: 50M10156, 50M10158*	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 20,161 $\times 10^{-6}/\text{hr.}$	MTBF (in hours): 49.6
Number of Components this Data Represents: 6	Total Hours of Operation: 943.0
Number of Failures Reported: 19	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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 * Drawing number difference is only to
 identify TM links.

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Nomenclature: Telemetry XO-10 Transmitter PAM/FM 30 Channel			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
<u>2</u>	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
<u>2</u>	None		Miscellaneous:
<u>15</u>	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10156, 50M10158 component:

The Telemetry XO-10 Transmitter transmits vehicle instrument readings and environmental conditions to remote ground stations by means of SS/FM and PAM/FM/FM operation.

Power Rating: 1.5 amp

Weight: 23 lb

Dimensions: 9.5 x 10 x 9.5 in.

Nine of the failures were reported on Inspection Reports. Ten failures were reported on Unsatisfactory Condition Reports. Four of the fifteen "out of specs" category were the result of the zero level pedestal being too high. Three were concerned with sub-carrier oscillating frequency: two were too high, one was too low.

DATA SHEET	
Nomenclature: Telemetry XO-11 Transmitter FM/FM/FM	
Drawing Numbers: 50M10471, 50M10474*	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 3,028 $\times 10^{-6}$ /hr.	MTBF (in hours): 330.2
Number of Components this Data Represents: 5	Total Hours of Operation: 660.4
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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* The different numbers are to differentiate between links: 471 is F5 link; 474 is F6 link.

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Nomenclature: Telemetry XO-11 Transmitter FM/FM/FM

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Fragile		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-6 through SA-7 Vehicles (less flight data)

COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: None Available

Additional information concerning the 50M10471, 50M10474 component:

The XO-11 telemetry transmitter transmits vehicle instrument readings and environmental conditions to remote ground stations by means of SS/FM and PAM/FM/FM operation.

Power Rating: 1.5 amp

Weight: 16.5 lb

Dimensions: 10.5 x 7.75 x 5 in.

Both failures were reported on Unsatisfactory Condition Reports.

1. The 52.5 KC subcarrier oscillator had pre-emphasis 15% high.
2. The 2.3 KC subcarrier, or the 52.5 KC main subcarrier, was 8% low in frequency at the low frequency band edge.

DATA SHEET	
Nomenclature: Telemetry UHF Transmitter	
Drawing Numbers: 10420614	Vendor: Microdot, Inc.
Saturn I Vehicle	Location:
Estimated Design Life: 1,000 hr.	
Failure Rate: $72,464 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 13.8
Number of Components this Data Represents: 3	Total Hours of Operation: 82.9
Number of Failures Reported: 6	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Telemetry UHF Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction	<u>1</u>	Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
<u>1</u>			
<u>2</u>			
<u>1</u>			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 10420614 component:

The UHF telemetry transmitter transmits vehicle instrument readings and environmental conditions to remote ground stations by means of SS/FM and PAM/FM/FM operation.

Four of the failures were reported on Inspection Reports. Two failures were reported on Unsatisfactory Condition Reports.

The noisy category complaint was "Becomes noisy after extended run time beyond ten minutes".

Erratic category "Very erratic output after 20 minutes run time".

DATA SHEET	
Nomenclature: PCM 270 Telemetry Transmitter	
Drawing Numbers: 10420613	Vendor: Dynatronics, Inc.
Saturn I Vehicle	Location:
Estimated Design Life: 1,000 hr.	
Failure Rate: $5,395 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 185.3
Number of Components this Data Represents: 3	Total Hours of Operation: 556.5
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: PCM 270 Telemetry Transmitter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
<u>2</u>	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 10420613 component:

The PCM 270 telemetry transmitter transmits vehicle instrument readings and environmental conditions to remote ground stations by means of SS/FM and PAM/FM/FM operation.

Two failures were reported on Unsatisfactory Condition Reports and one was reported on an Inspection Report.

One "in error" category failure was later found to be a mismatch of transistors in Beta parameters. Replacement with matched pairs corrected the discrepancy.

SUMMARY SHEET

Nomenclature: Transmitter, RF Assembly P-1

Drawing Numbers: 50M10487,
50M10488

Vendor: United
Electrodynamics

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: $92,592 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 10.8

Total Number of Components
this Data Represents 5

Total Hours of Operation: 43.2

Total Number of
Failures Reported 4

Vehicle Equipment: X
Ground Equipment:

Nomenclature: Transmitter, RF Assembly P-1

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
<u>2</u>	Oscillation/Fluctuation		Reported as Burned Parts
<u>1</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)

DATA SHEET	
Nomenclature: Transmitter, RF Assembly P-1	
Drawing Numbers: 50M10487	Vendor: United Electrodynamics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: $76,335 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 13.1
Number of Components this Data Represents: 2	Total Hours of Operation: 18.1
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Transmitter, RF Assembly P-1			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Transmitter, RF Assembly P-1	
Drawing Numbers: 50M10488	Vendor: United Electrodynamics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 158,730 x 10 ⁻⁶ /hr.	MTBF (in hours): 6.3
Number of Components this Data Represents: 3	Total Hours of Operation: 25.1
Number of Failures Reported: 4	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

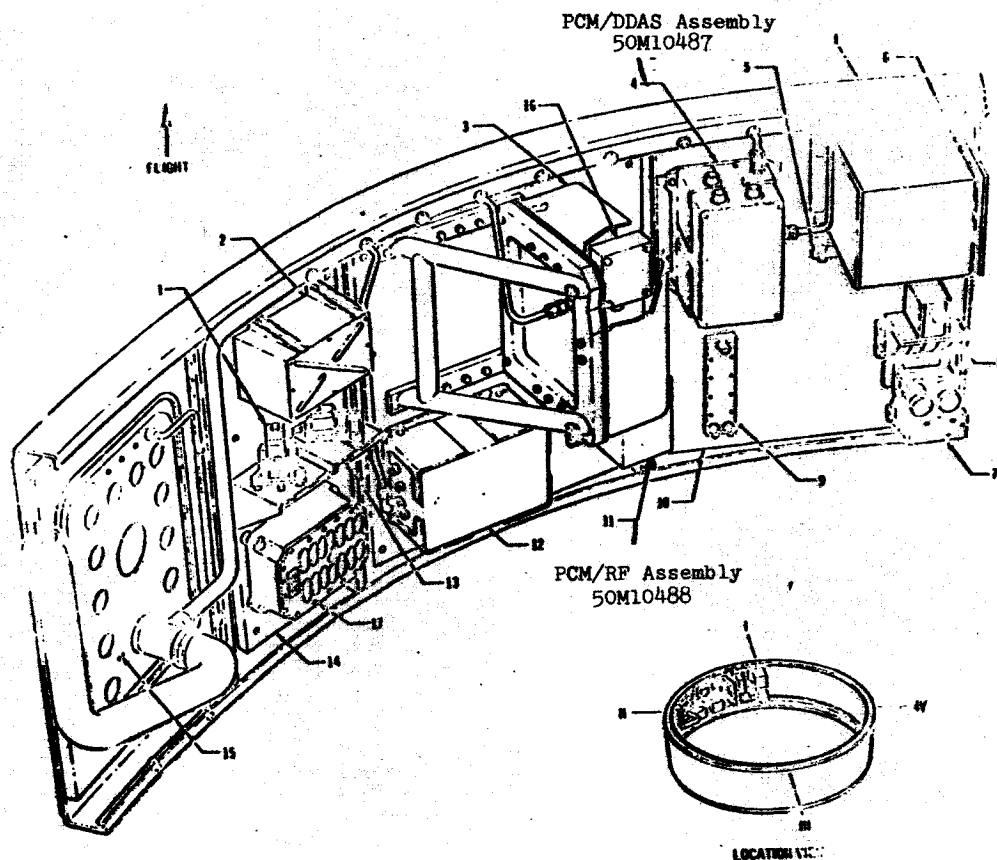
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Nomenclature: Transmitter, RF Assembly P-1			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
<u>1</u>			
<u>2</u>			
<u>1</u>			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10487, 50M10488 component:

Three failures were reported on Unsatisfactory Condition Reports and one on an Inspection Report.



SUMMARY SHEET

Nomenclature: Transmitter, Model B RF Assembly E5

Drawing Numbers: 50M10671,
50M10678

Vendor: NASA/MSFC Astrionics

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: $27,027 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 37.0

**Total Number of Components
this Data Represents** 6

Total Hours of Operation:
111.2

**Total Number of
Failures Reported** 3

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: Transmitter, Model B RF Assembly E5

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
<u>2</u>	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)

DATA SHEET	
Nomenclature: Transmitter, Model B RF Assembly E5	
Drawing Numbers: 50M10671	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 58,479 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 3 Number of Failures Reported: 1	MTBF (in hours): 17.1 Total Hours of Operation: 17.1 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Transmitter, Model B RF Assembly E5			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Transmitter, Model B RF Assembly F5	
Drawing Numbers: 50M10678	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 21,231 x 10 ⁻⁶ /hr.	MTBF (in hours): 47.1
Number of Components this Data Represents: 3	Total Hours of Operation: 94.1
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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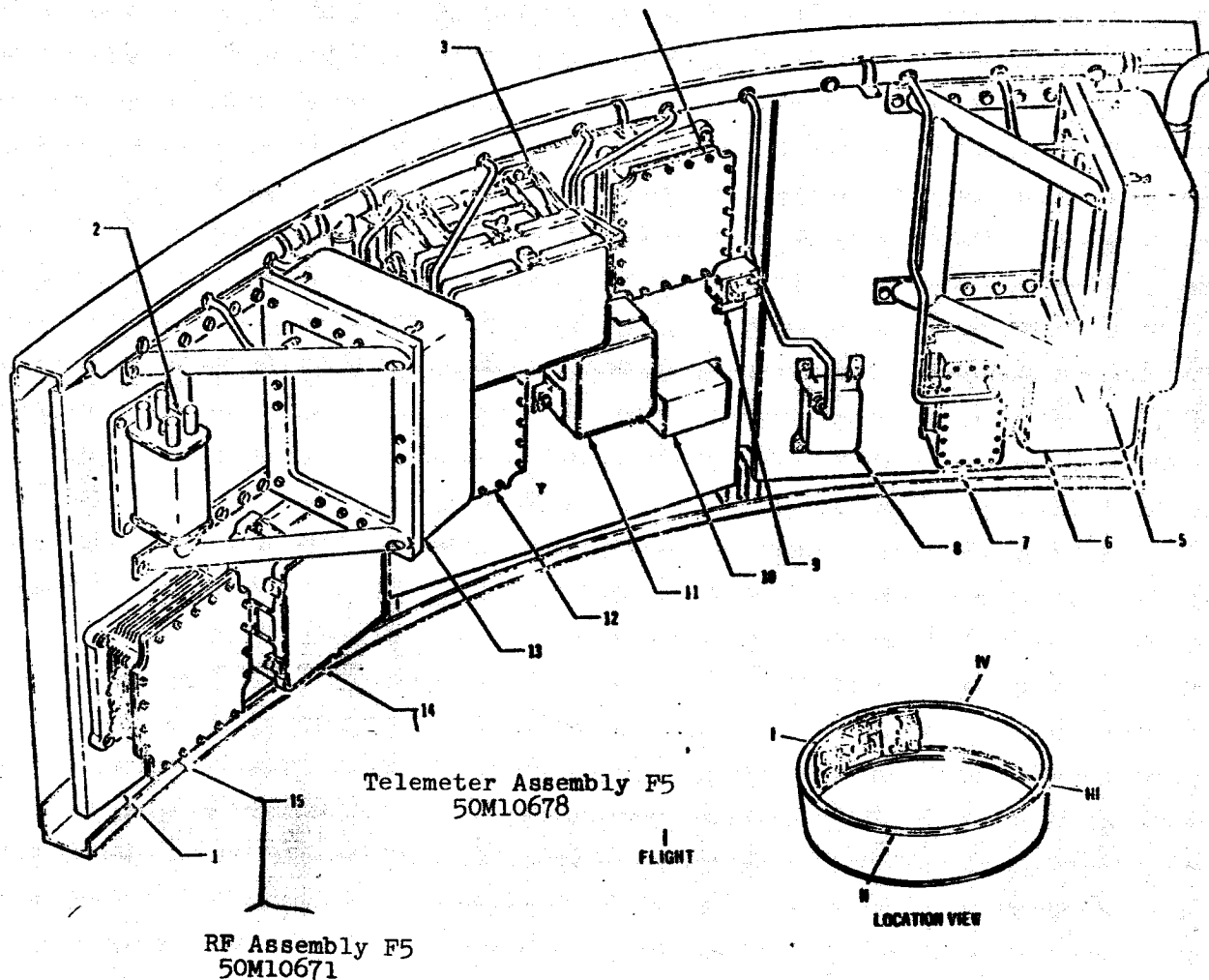
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Nomenclature: Telemetry, Model A RF Assembly F6

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
<u>1</u>			
<u>1</u>			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10671, 50M10678 components:

The three failures were reported on Unsatisfactory Condition Reports.



SUMMARY SHEET

Nomenclature: Telemetry, Model A RF Assembly F6

Drawing Numbers: 50M10679,
50M10672

Vendor: NASA/MSFC Astrionics

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: $7,473 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 133.8

Total Number of Components
this Data Represents 8

Total Hours of Operation:
535.0

Total Number of
Failures Reported 4

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: Telemetry, Model A RF Assembly F6

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency)		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other: 1
<u>1</u>	Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		10% roll-off on the trailing edge of the master pulse

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)

DATA SHEET	
Nomenclature: Telemetry, Model A RF Assembly F6	
Drawing Numbers: 50M10672	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 82,987 x 10 ⁻⁶ /hr.	MTBF (in hours): 12.05
Number of Components this Data Represents: 4	Total Hours of Operation: 24.1
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Telemetry, Model A RF Assembly F6			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other: 1 10% roll-off on the trailing edge of the master pulse
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Telemetry, Model A RF Assembly F6	
Drawing Numbers: 50M10679	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: $3,913 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 255.5
Number of Components this Data Represents: 4	Total Hours of Operation: 510.9
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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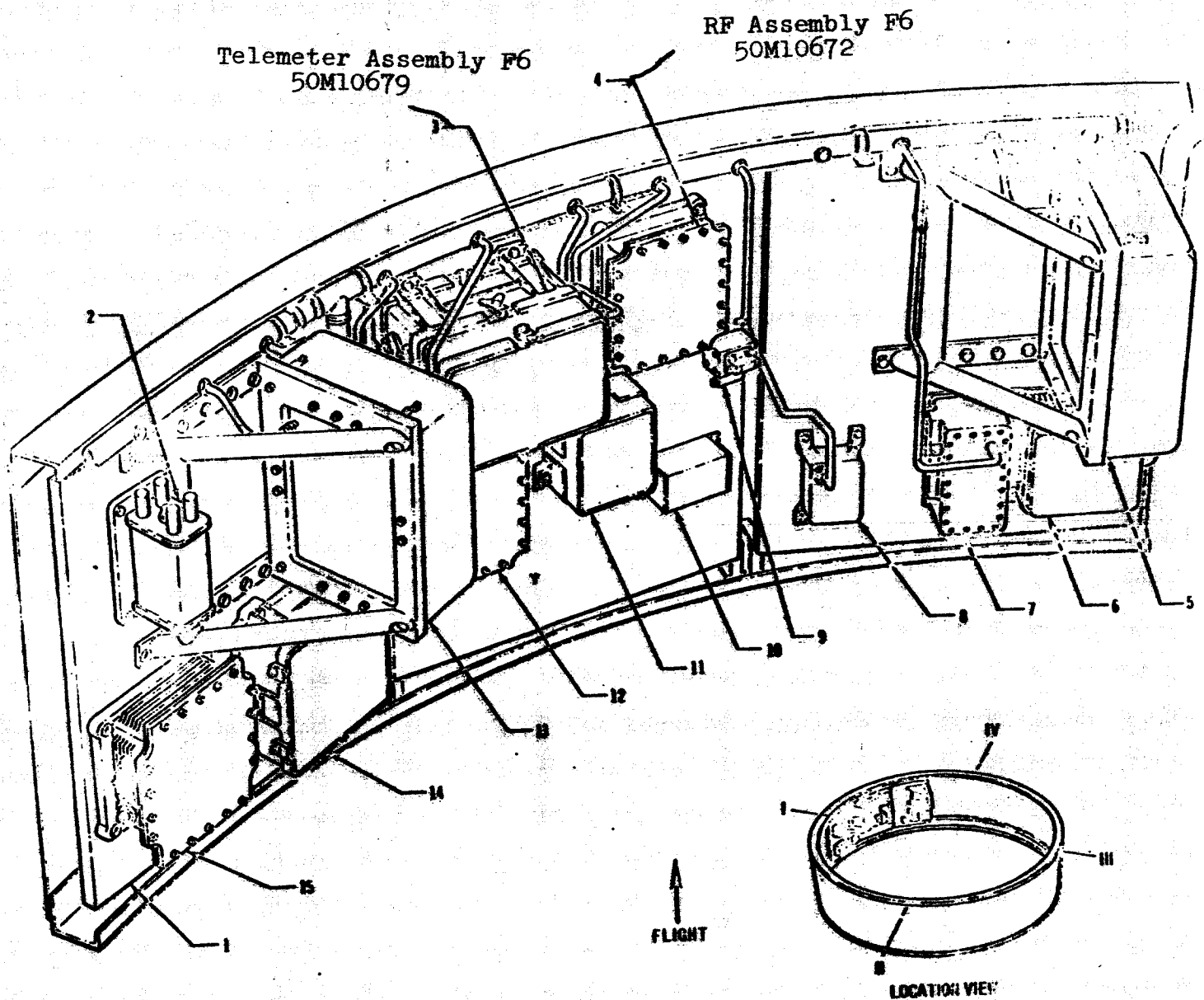
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Nomenclature: Telemetry, Model A RF Assembly F6

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
<u>1</u>	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>1</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10672, 50M10679 component:

Three failures were reported on Unsatisfactory Condition Reports and one on an Inspection Report.



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SUMMARY SHEET

Nomenclature: TV Camera Control

Drawing Numbers: 50M10254,
50M10429, 50M10455

Vendor: Lear Siegler

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 500 hr.

Failure Rate: $1,177 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 849.0

Total Number of Components
this Data Represents 9

Total Hours of Operation:
1,174.4

Total Number of
Failures Reported 0

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: TV Camera Control			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 vehicles (less flight data)			

DATA SHEET	
Nomenclature: TV Camera Control	
Drawing Numbers: 50M10254	Vendor: Lear Siegler
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 500 hr.	
Failure Rate: $12,500 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 80.0
Number of Components this Data Represents: 4	Total Hours of Operation: 111.7
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>5 to 20 g</u>	
Altitude: <u>250,000 ft</u>	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>80°C</u>	
Low Temperature: <u>-20°C</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>to 20 g</u>	
Sine Wave Method: <u>0 to 2,000 cps</u>	
Vibration:	

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Nomenclature: TV Camera Control

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC temperature, vibration and altitude laboratory notebooks (no title or report number)			

DATA SHEET

Nomenclature: TV Camera Control

Drawing Numbers: 50M10429

Vendor: Lear Siegler

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 500 hr.

Failure Rate: $19,493 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 51.3

Number of Components
this Data Represents: 1

Total Hours of Operation: 71.2

Number of
Failures Reported: 0

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:

Acceleration: 5 to 20 g

Altitude: 250,000 ft

Radio Interference:

Salt Spray:

Shock:

High Temperature: 80°C

Low Temperature: -20°C

Ambient Room Temperature:

Thermal Shock:

Shock Impact (Flat Drop):

Leakage Rate:

Humidity:

Random Noise: to 20 g

Sine Wave Method: 0 to 2,000 cps

Vibration:

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Nomenclature: TV Camera Control			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted: Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC temperature, vibration and altitude laboratory notebooks (no title or report number)			

DATA SHEET

Nomenclature: TV Camera Control

Drawing Numbers: 50M10455

Vendor: Lear Siegler

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 500 hr.

Failure Rate: $1,398 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 715.0

Number of Components
this Data Represents: 4

Total Hours of Operation: 991.4

Number of
Failures Reported: 0

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:

Acceleration: 5 to 20 g

Altitude: 250,000 ft

Radio Interference:

Salt Spray:

Shock:

High Temperature: 80°C

Low Temperature: -20°C

Ambient Room Temperature:

Thermal Shock:

Shock Impact (Flat Drop):

Leakage Rate:

Humidity:

Random Noise: to 20 g

Sine Wave Method: 0 to 2,000 cps

Vibration:

Nomenclature: TV Camera Control			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-6 and SA-7 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC temperature, vibration and altitude laboratory notebooks (no title or report number)			

Additional information concerning the 50M10254, 50M10429,
50M10455 component:

The camera control (television) is comprised of power converter, power supplies, sweep generators, sync generator, blanking generator, video amplifier, sync adder, and the output divider. It is the control for the TV camera head.

Power Rating: 14 watts

Weight: 7 lb

Dimensions: 9 x 6.25 x 3.75 in.

SUMMARY SHEET

Nomenclature: AZUSA Transponder

Drawing Numbers: 50M10448,
8968413, 50M12266

Vendor: General Dynamics/
Astronautics

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 100 hr.

Failure Rate: $6,337 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 157.8

Total Number of Components
this Data Represents 16

Total Hours of Operation:
315.6

Total Number of
Failures Reported 2

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: AZUSA Transponder

FREQUENCY
OF
OCCURRENCE

FAILURE
INDICATIONS

FREQUENCY
OF
OCCURRENCE

FAILURE
INDICATIONS

Impedance:

Low

High

Output:

Distorted

Erratic

Excessive Null

Excessive Roll

Unwanted Signal

High

In Error

Intermittent

Loss of Some Voltages

Low

Low Sensitivity

Low Speed

No Lock On (Frequency)

Noisy

None

Oscillation/Fluctuation

Out of Specs

Out of Synchronization

Over Modulation

Overspeed

Regulation

Shorted

Reverses Polarity

Reverses Direction

Pressure:

High

Low

None

Input:

Inoperative

Fuses:

Blows/Blown

Blowers:

Inoperative

Intermittent

Mechanical:

Pins Shorted

Indicators/
Dials Are In
Error

Indicators/
Dials Are In-
operative

Lamps:

Will Not Light

Stay On

Miscellaneous:

Reported as
Burned Parts

Other:

1

1

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 vehicles (less flight data)

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DATA SHEET	
Nomenclature: AZUSA Transponder	
Drawing Numbers: 50M10448	Vendor: General Dynamics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 24,096 x 10 ⁻⁶ /hr.	MTBF (in hours): 41.5
Number of Components this Data Represents: 3	Total Hours of Operation: 58.1
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>20 g for one minute in each direction along each 3 mutually perpendicular axes</u>	
Altitude: <u>200,000 feet</u>	
Radio Interference:	
Salt Spray: <u>Solution of 5% NCL by weight and 95% H₂O by weight for 48 hours</u>	
Shock:	
High Temperature: <u>100°F</u>	
Low Temperature: <u>-60°C</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>16 hr. 38°C, 85% (minimum), 6 hr. 50°C, 95%</u>	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: AZUSA Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-6 and SA-7 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC/R-ASTR Test Data and Convair Report No. 27A671R, August 23, 1960			

DATA SHEET	
Nomenclature: AZUSA Transponder	
Drawing Numbers: 50M12266	Vendor: General Dynamics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 8,576 x 10 ⁻⁶ /hr.	MTBF (in hours): 116.6
Number of Components this Data Represents: 5	Total Hours of Operation: 116.6
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: AZUSA Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: AZUSA Transponder	
Drawing Numbers: 8968413	Vendor: General Dynamics/ Astronautics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 7,097 x 10 ⁻⁶ /hr.	MTBF (in hours): 140.9
Number of Components this Data Represents: 8	Total Hours of Operation: 140.9
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: AZUSA Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-5 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10448, 8968413,
50M12266 component:

The AZUSA Transponder provides a means to obtain real time position and velocity information. It allows for a prediction of the impact point and receives ground signals and retransmits signal to ground at offset frequency.

Drawing No. 8968413

Power Rating: 134 watts (5,000 megacycles at 28-volt
input, 15.5 amp)

Weight: 42 lb

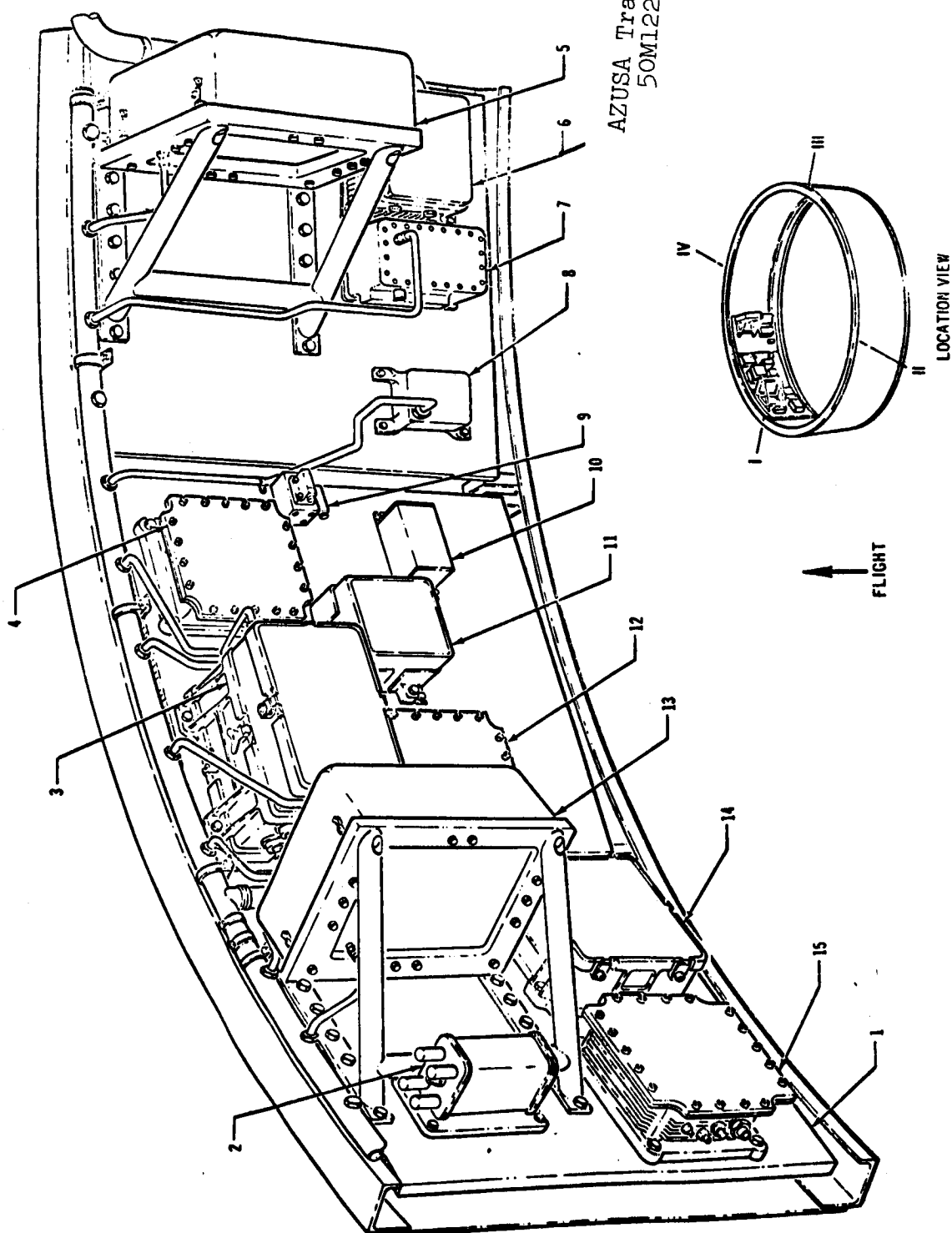
Dimensions: 10.5 in diameter x 11.75 in length

Drawing No. 50M10448

Power Rating: 28-volt input

Dimensions: 9.05 x 9.025 x 4.60 in

The two failures were reported on Unsatisfactory Condition Reports.



AZUSA Transponder
50M12266

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SUMMARY SHEET

Nomenclature: Mistram Transponder

Drawing Numbers: 50M10123,
50M12268

Vendor: General Electric

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 500 hr.

Failure Rate: $34,364 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 29.1

Total Number of Components
this Data Represents 13

Total Hours of Operation:
290.5

Total Number of
Failures Reported 10

Vehicle Equipment: X
Ground Equipment:

Nomenclature: Mistram Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
<u>1</u>	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High	<u>1</u>	Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
<u>3</u>	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
<u>2</u>	None		Miscellaneous:
<u>1</u>	Oscillation/Fluctuation		Reported as Burned Parts
<u>2</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 vehicles (less flight data)			

DATA SHEET	
Nomenclature: Mistram Transponder	
Drawing Numbers: 50M10123	Vendor: General Electric
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 500 hr.	
Failure Rate: 23,923 $\times 10^{-6}$ /hr.	MTBF (in hours): 41.8
Number of Components this Data Represents: 8	Total Hours of Operation: 208.7
Number of Failures Reported: 5	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>20 g for one minute in each direction of 3 orthogonal axes</u>	
Altitude:	
Radio Interference:	
Salt Spray: <u>5% solution at 35°C for 48 hr.</u>	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity: <u>240 hr. at 95% which included temperature cycling from 68 to 122°F</u>	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Mistram Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High	<u>1</u>	Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
<u>2</u>	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
<u>1</u>	Oscillation/Fluctuation		Reported as Burned Parts
<u>1</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: General Electric Report LMED-REQN-47601, June 6, 1962			

DATA SHEET	
Nomenclature: Mistram Transponder	
Drawing Numbers: 50M12268	Vendor: General Electric
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 500 hr.	
Failure Rate: $61,349 \times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 5 Number of Failures Reported: 5	MTBF (in hours): 16.3 Total Hours of Operation: 81.7 Vehicle Equipment: Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Mistram Transponder

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed <u>1</u> No Lock On (Frequency) Noisy <u>2</u> None Oscillation/Fluctuation <u>1</u> Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

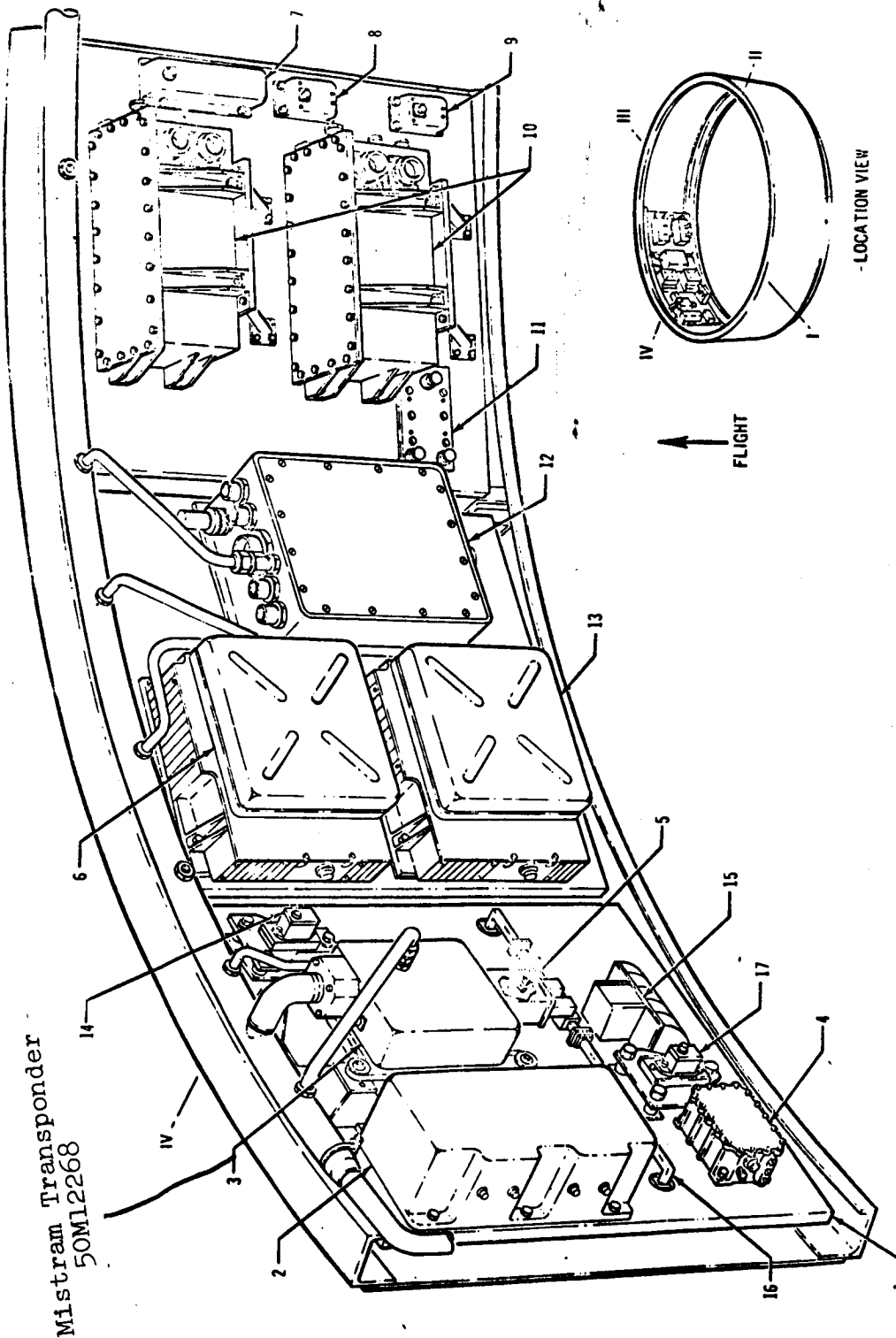
Additional information concerning the 50M10123, 50M12268 component:

The Mistram Transponder provides an independent precision measuring system to determine the position and velocity of the vehicle. It receives signals from ground stations, amplifies and shifts these in frequency and retransmits them back to the ground stations.

Power Rating: 145 watts, 28 vdc

Dimensions: 12.03 x 5.35 x 8.88 in.

Seven failures were reported on Unsatisfactory Condition Reports, and three failures were reported on Inspection Reports.



INSTRUMENT UNIT GROUP ASSEMBLIES -

SUMMARY SHEET

Nomenclature: ODOP Transponder

Drawing Numbers: 50M12009,
50M12181

Vendor: Motorola

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 1,000 hr.

Failure Rate: $10,952 \times 10^{-6}/\text{hr.}$ MTBF (in hours): 91.3

Total Number of Components
this Data Represents 7

Total Hours of Operation:
126.4

Total Number of
Failures Reported 0

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: ODOP Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 vehicles (less flight data)			

DATA SHEET	
Nomenclature: ODOP Transponder*	
Drawing Numbers: 50M12009	Vendor: Motorola
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: $13,175 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 75.9
Number of Components this Data Represents: 4	Total Hours of Operation: 105.1
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>20 g for one minute in each plane</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>40 g for 11 milliseconds (2 directions in each of 3 mutually perpendicular axes)</u>	
High Temperature: <u>85°C</u>	
Low Temperature: <u>-50°C</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>12 g for 180 sec, 21 g for 4 sec, 7.5 g for 410 sec (in each of 3 mutually perpendicular planes)</u>	
Sine Wave Method: <u>planes</u>	
Vibration:	

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* 960 megacycle power amplifier not included

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Nomenclature: ODOP Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5, 6, 7 and 9 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report M-ASTR-IN-63-5, 1963			

DATA SHEET	
Nomenclature: ODOP Transponder	
Drawing Numbers: 50M12181	Vendor: Motorola
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: $64,935 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 15.4
Number of Components this Data Represents: 3	Total Hours of Operation: 21.3
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: ODOP Transponder			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

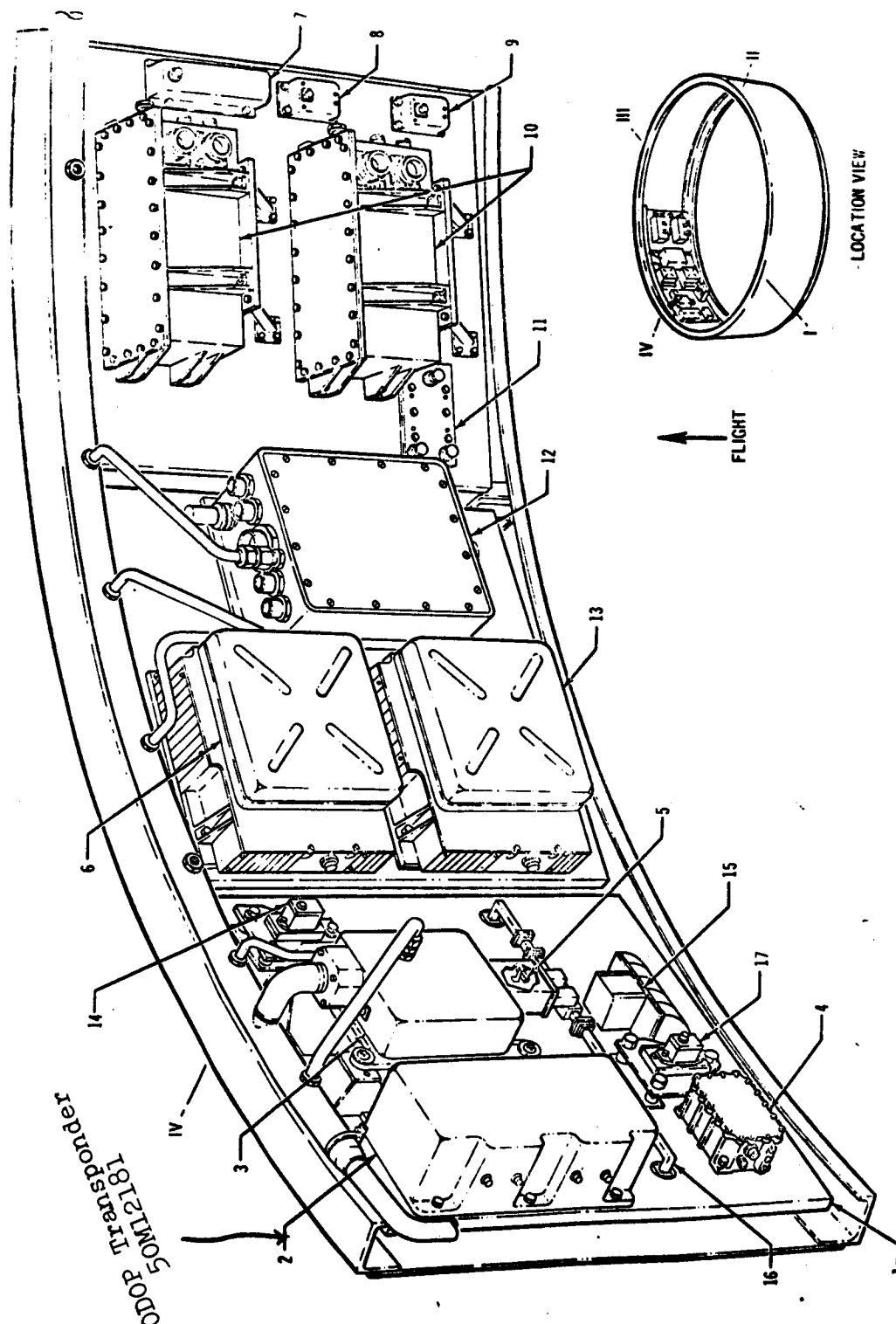
Additional information concerning the 50M12009, 50M12181 component:

The ODOP Transponder is used for vehicle tracking. It receives a continuous ground signal at a frequency of 890 cps, offsets the input signal by 70 cps, amplifies and retransmits it to ground at a frequency of 960 cps.

Power Rating: 28 volts, 0.4 amp

Weight: 19.75 lb

Dimensions: 9.31 x 8 x 5.56 in.



INSTRUMENT UNIT GROUP ASSEMBLIES -

December 1965 (Revision)
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SUMMARY SHEET

Nomenclature: Radar Transponder "C" Band

Drawing Numbers: 8961356,
50M10682, 50M12261

Vendor: Motorola, American
Car and Foundry (Electronics
Division)

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 100 hr.

Failure Rate: $33,784 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 29.6

Total Number of Components
this Data Represents 16

Total Hours of Operation:
325.4

Total Number of
Failures Reported 11

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: Radar Transponder "C" Band

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
<u>1</u>	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>6</u>	Low		Indicators/ Dials Are In Error
<u>2</u>	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
<u>1</u>	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-1 through SA-10 vehicles (less flight data)

DATA SHEET	
Nomenclature: Radar Transponder "C" Band RT 473/DPN55	
Drawing Numbers: 8961356 Saturn I Vehicle	Vendor: American Car and Foundry (Electronics Division) Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 35,971 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 12 Number of Failures Reported: 9	MTBF (in hours): 27.8 Total Hours of Operation: 250.9 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: <u>5 g for 60 sec</u>	
Sine Wave Method:	
Vibration:	

Nomenclature: Radar Transponder "C" Band RT 473/DPN55			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>5</u>	Low		Indicators/ Dials Are In Error
<u>2</u>	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
<u>1</u>	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-1 through SA-7 vehicles (less CALENDAR TIME DATA REPRESENTS: flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Transponder Lab. Verbal Information			

DATA SHEET	
Nomenclature: Radar Transponder "C" Band	
Drawing Numbers: 50M10682	Vendor: Motorola
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 39,062 x 10 ⁻⁶ /hr.	MTBF (in hours): 25.6
Number of Components this Data Represents: 1	Total Hours of Operation: 25.6
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
<p>ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:</p> <p>Acceleration:</p> <p>Altitude:</p> <p>Radio Interference:</p> <p>Salt Spray:</p> <p>Shock:</p> <p>High Temperature:</p> <p>Low Temperature:</p> <p>Ambient Room Temperature:</p> <p>Thermal Shock:</p> <p>Shock Impact (Flat Drop):</p> <p>Leakage Rate:</p> <p>Humidity:</p> <p>Random Noise: Same as page 3</p> <p>Sine Wave Method:</p> <p>Vibration:</p>	

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Nomenclature: Radar Transponder "C" Band				
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	
<u>1</u>	Impedance:		Pressure:	
	Low		High	
	High		Low	
	Output:		None	
	Distorted		Input:	
	Erratic		Inoperative	
	Excessive Null		Fuses:	
	Excessive Roll		Blows/Blown	
	Unwanted Signal		Blowers:	
	High		Inoperative	
	In Error		Intermittent	
	Intermittent		Mechanical:	
	Loss of Some Voltages		Pins Shorted	
	Low		Indicators/ Dials Are In Error	
	Low Sensitivity		Indicators/ Dials Are In- operative	
	Low Speed		Lamps:	
	No Lock On (Frequency)		Will Not Light	
	Noisy		Stay On	
	None		Miscellaneous:	
	Oscillation/Fluctuation		Reported as Burned Parts	
	Out of Specs		Other:	
	Out of Synchronization			
	Over Modulation			
	Overspeed			
	Regulation			
	Shorted			
	Reverses Polarity			
	Reverses Direction			
	DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
	CALENDAR TIME DATA REPRESENTS: SA-9 vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:				

DATA SHEET	
Nomenclature: Radar Transponder "C" Band	
Drawing Numbers: 50M12261	Vendor: Motorola
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 20,449 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 3 Number of Failures Reported: 1	MTBF (in hours): 48.9 Total Hours of Operation: 48.9 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise: \ Same as page 3	
Sine Wave Method:	
Vibration:	

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Nomenclature: Radar Transponder "C" Band			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

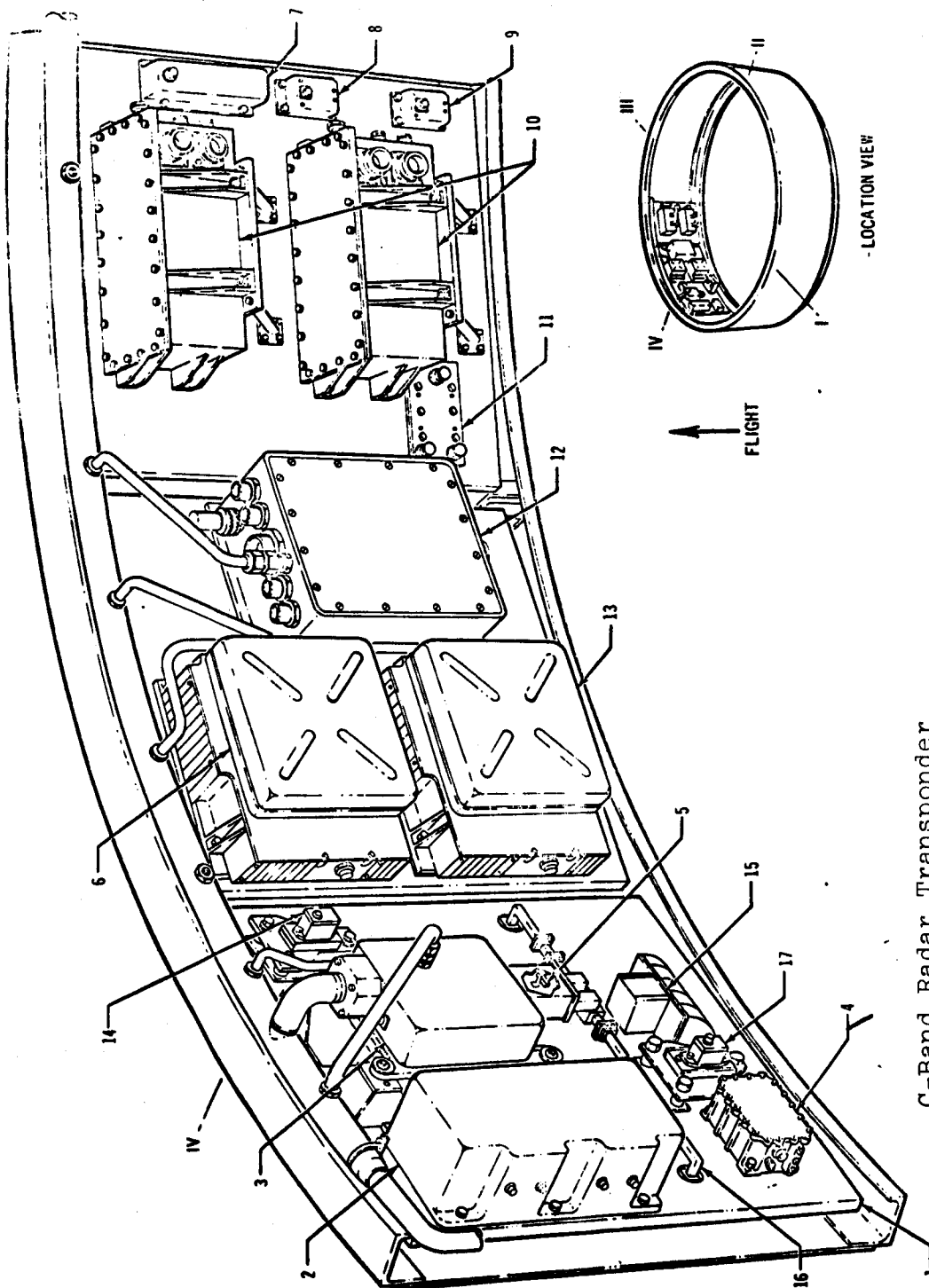
Additional information concerning the 8961356, 50M10682,
50M12261 component:

The "C" Band Radar Transponder acts in response to pulse interrogations from ground transmitters. It extends the range of ground tracking stations. It receives coded or uncoded pulses from ground and transmits tracking pulse to ground in response.

Power Rating: 28 vdc

Dimensions: 9.66 x 7.14 x 4.38 in.

Eight failures were reported on Inspection Reports and three were reported on Unsatisfactory Condition Reports.



C-Band Radar Transponder
50M12261

INSTRUMENT UNIT GROUP ASSEMBLIES -

DATA SHEET	
Nomenclature: Radar Transponder "S" Band	
Drawing Numbers: 8960442	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: $27,777 \times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 2 Number of Failures Reported: 0	MTBF (in hours): 36.0 Total Hours of Operation: 50.1 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

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Nomenclature: Radar Transponder "S" Band			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 and SA-2 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 8960442 component:

The "S" Band Radar Transponder acts in response to pulse interrogations from ground transmitters. It extends the range of ground tracking stations; receives coded or uncoded pulses from the ground and transmits tracking pulse to the ground in response.

DATA SHEET	
Nomenclature: Radar Transponder SST-131	
Drawing Numbers: 50M10187	Vendor: Motorola
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 32,258 x 10 ⁻⁶ /hr.	MTBF (in hours): 31.0
Number of Components this Data Represents: 3	Total Hours of Operation: 31.0
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Radar Transponder SST-131			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
Reverses Direction			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 Vehicle only (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 50M10187 component:

The SST-131 Radar Transponder is used in conjunction with the FPS-16 radar ground station to provide one source of real time trajectory to the range safety officer. It also provides data for post flight analysis.

One failure was reported on an Unsatisfactory Condition Report.

SUMMARY SHEET

Nomenclature: UDOP Transponder AN/DRN-7 AN/DRN-11

Drawing Numbers: 8960300,
50M10006, 50M10317

Vendor: MSFC, Motorola,
Gilfillan Brothers

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 100 hr.

Failure Rate: $2,976 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 336.0

Total Number of Components
this Data Represents 12

Total Hours of Operation:
336.0

Total Number of
Failures Reported 1

Vehicle Equipment: X
Ground Equipment:

Nomenclature: UDOP Transponder, AN/DRN-7, AN/DRN-11

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-1 through SA-7 Vehicles (less flight data)

DATA SHEET	
Nomenclature: UDOP Transponder, AN/DRN-7	
Drawing Numbers: 8960300	Vendor: Gilfillan Brothers, MSFC
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: 15,873 $\times 10^{-6}$ /hr.	MTBF (in hours): 63.0
Number of Components this Data Represents: 4	Total Hours of Operations: 88.1
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: UDOP Transponder, AN/DRN-7			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 and SA-2 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 8960300 component:

Power Rating: 115 volts, 400 cps, 3 phase, 200 watts,

RF power output 20 watts

Band width - 250 kc

Sensitivity - (1/2 power) 5 mv

Frequency:

input - 450 megacycles

output - 900 megacycles

Weight: 50 lb

Dimensions: 12.625 x 14.875 x 7.75 in.

(Intentionally Left Blank)

DATA SHEET	
Nomenclature: UDOP Transponder AN/DRN-11	
Drawing Numbers: 50M10006	Vendor: Motorola
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: $20,450 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 48.9
Number of Components this Data Represents: 3	Total Hours of Operation: 48.9
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	<u>15 g for 5 minute in each direction along each of its 3 mutually perpendicular axes</u>
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	<u>20 g for 11 milliseconds, square wave (2 directions on each of the 3 major axes)</u>
High Temperature:	<u>2 hr. at 160°F</u>
Low Temperature:	<u>2 hr. at -10°F</u>
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	<u>Not to exceed one psi/hr.</u>
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	<u>10-30 cps at 0.2 in. D.A. (in each of 3 perpendicular axes) 30-1,000 cps at 8 g (peak), 1,000-2,000 cps at 10 g</u>

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Nomenclature: UDOP Transponder AN/DRN-11			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Army Ballistic Missile Agency Report DG-TM-16-60, April 6, 1960			

DATA SHEET	
Nomenclature: UDOP Transponder AN/DRN-11	
Drawing Numbers: 50M10317	Vendor: Motorola
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 100 hr.	
Failure Rate: $5,571 \times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 5 Number of Failures Reported: 0	MTBF (in hours): 179.5 Total Hours of Operation: 198.9 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Acceleration: <u>15 g for 5 minutes on each direction along each of its 3 mutually perpendicular axes</u> Altitude: Radio Interference: Salt Spray: Shock: <u>20 g for 11 milliseconds, square wave (2 directions on each of the 3 major axes)</u> High Temperature: <u>2 hr. at 160°F</u> Low Temperature: <u>2 hr. at -10°F</u> Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: <u>Not to exceed 1 psi/hr.</u> Humidity: Random Noise: Sine Wave Method: Vibration: <u>10 to 30 cps at 0.2 in. D.A. (in each 3 perpendicular axes) 30 to 1,000 cps at 8 g (peak), 1,000 to 2,000 cps at 10 g</u>	

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Nomenclature: UDOP Transponder AN/DRN-11			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Army Ballistic Missile Agency Report DG-TM-16-60, April 6, 1960			

Additional information concerning the 50M10006, 50M10317 component:

The UDOP Transponder receives CW carrier from ground stations, doubles the received frequency and re-radiates it back to the ground stations. It provides data for accurately tracking the missile.

Power Rating: 28 vdc, 80 watts

Weight: 10.25 lb

Dimensions: 4.6 x 4.6 x 8.6 in.

RF power output - 3 watts

Bandwidth - 150 kc

Sensitivity (1/2 power) - 3 mv

Frequency

input - 450 megacycles

output - 900 megacycles

DATA SHEET	
Nomenclature: Radar Altimeter	
Drawing Numbers: 50M12076	Vendor: Ryan Aeronautical
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life:	
Failure Rate: $185,185 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 5.4
Number of Components this Data Represents: 3	Total Hours of Operation: 37.5
Number of Failures Reported: 7	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>15 g for 5 minutes on X, Y, Z axes</u>	
Altitude:	
Radio Interference: <u>per MIL-I-26600</u>	
Salt Spray:	
Shock:	
High Temperature: <u>75°C</u>	
Low Temperature: <u>-20°C</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop): <u>20 g for 8 milliseconds (sine wave)</u>	
Leakage Rate: <u>at 20 psi not more than 0.1 psi per hr.</u>	
Humidity: <u>ambient to 80% relative</u>	
Random Noise:	
Sine Wave Method:	
Vibration: <u>10-50 cps at 2 g, 50-110 cps at 0.16 in. D.A.</u> <u>110-2,000 cps at 10 g, 20-45 cps at 1 g, 45-</u> <u>95 cps at 0.01 in. D.A., 95-2,000 cps at 5 g</u>	

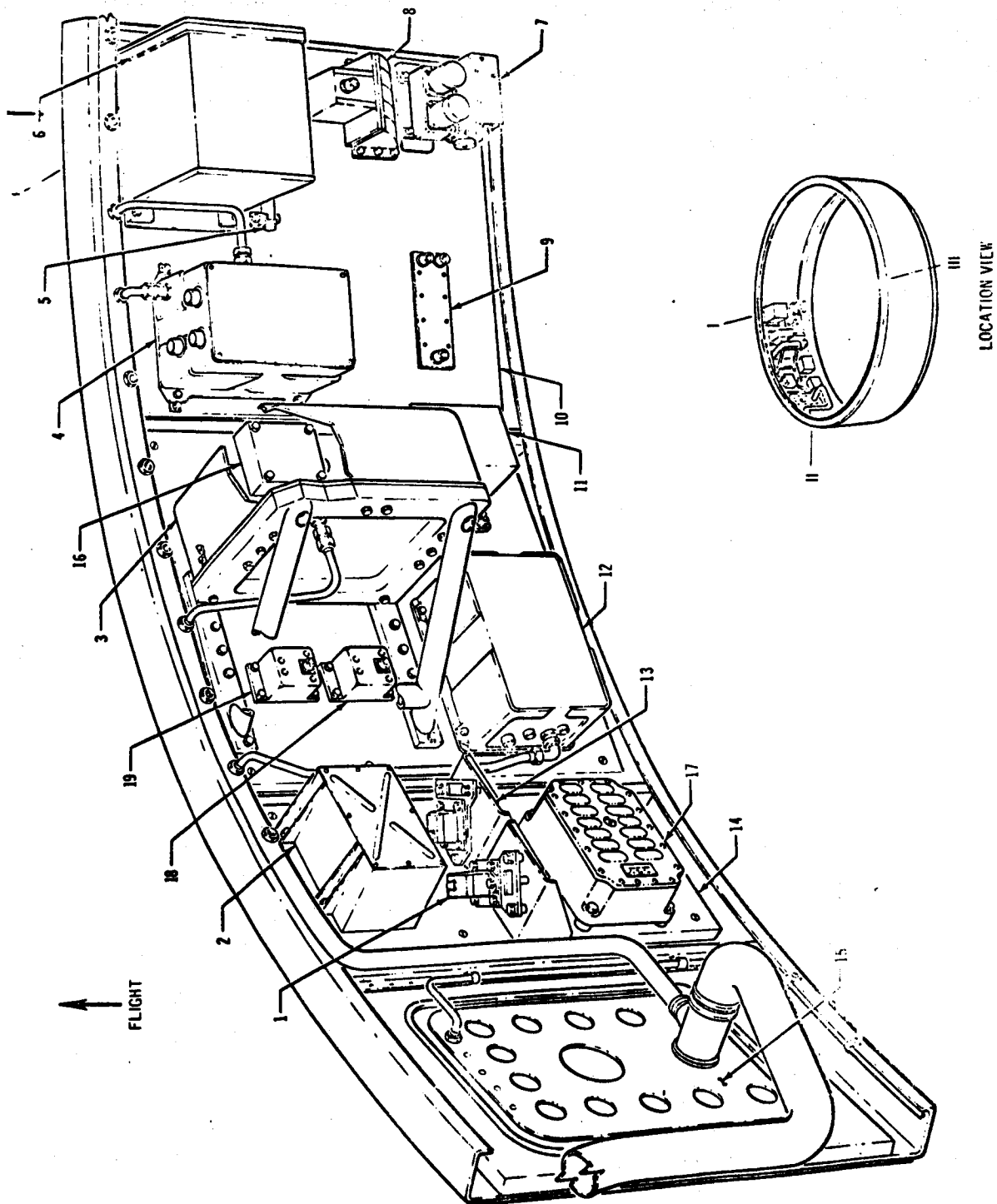
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Nomenclature: Radar Altimeter			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:	<u>1</u>	None
	Distorted		Input:
	Erratic	<u>2</u>	Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
<u>1</u>	Low		Indicators/ Dials Are In Error
<u>1</u>	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
<u>2</u>	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-8 and SA-10 Vehicles (less flight CALENDAR TIME DATA REPRESENTS: data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Ryan Electronics Report No. 52065-2A Feb. 1962			

Additional information concerning the 50M12076 component:

Four failures were reported on Inspection Reports, three were reported on Unsatisfactory Condition Reports.



INSTRUMENT UNIT GROUP ASSEMBLIES -

DATA SHEET	
Nomenclature: Control Voltage Supply	
Drawing Numbers: 10421910	Vendor: NASA/MSFC Astrionics
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 1,000 hr.	
Failure Rate: 866 x 10 ⁻⁶ /hr. Number of Components this Data Represents: 13 Number of Failures Reported: 0	MTBF (in hours): 1154.0 Total Hours of Operation: 1599.2 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Acceleration: <u>20 g along each of three main axes for 20 minutes each plane</u> Altitude: <u>20 minutes at constant atmospheric pressure between sea level and 1/3 sea level value</u> Radio Interference: Salt Spray: Shock: <u>2 shocks of 30 g for 11 milliseconds in each direction of the main axes</u> High Temperature: <u>50°C</u> Low Temperature: <u>-20°C</u> Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: <u>10 to 2,000 cps</u> Vibration: <u>0.125 in. D.A. displacement at 10 to 55 cps</u>	

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Nomenclature: Control Voltage Supply			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-1 through SA-7 Vehicles (less CALENDAR TIME DATA REPRESENTS: flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report #40M39505, January 28, 1964			

Additional information concerning the 10421910 component:

The Control Voltage Supply provides 60 vdc to energize angle-to-attack transducers and the actuator potentiometers on each engine.

Power Rating: 60 vdc output, 115 vac rms input
Input Frequency: 398 to 402 cps
Weight: 10.6 lb
Dimensions: 11.25 x 7.125 x 4.75 (294 cu in.)

SUMMARY SHEET

Nomenclature: Master Measuring Voltage Supply (5 vps)

Drawing Numbers: 40M20002,
40M21881

Vendor: Gulton Industries

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 3,000 hr.

Failure Rate: $423 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 2,360

**Total Number of Components
this Data Represents** 27

Total Hours of Operation:
9,440

**Total Number of
Failures Reported** 4

Vehicle Equipment: X
Ground Equipment:

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Nomenclature: Master Measuring Voltage Supply (5 vps)			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic	<u>1</u>	Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
<u>1</u>	Regulation POOR		
<u>1</u>	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-10 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Master Measuring Voltage Supply (5 vps)	
Drawing Numbers: 40M20002	Vendor: Gulton Industries
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 3,000 hr.	
Failure Rate: $557 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 1,795.2
Number of Components this Data Represents: 20	Total Hours of Operation: 7,180.7
Number of Failures Reported: 4	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>3 mutually perpendicular axes, 20 min, 20 g</u>	
Altitude: <u>35 minutes at 1.9×10^{-5} atmospheres</u>	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>85°C</u>	
Low Temperature: <u>-50°C</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>10-55 cycles at 20 g, 55-2,000 cycles at 20 g, 60 minutes</u>	

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Nomenclature: Master Measuring Voltage Supply (5 vps)			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic	<u>1</u>	Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
<u>1</u>	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
<u>1</u>	Regulation		
<u>1</u>	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-7 plus SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC-ASTR-IN-63-15			

DATA SHEET	
Nomenclature: Master Measuring Voltage Supply (5 vps)	
Drawing Numbers: 40M20881	Vendor: Gulton Industries
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 3,000 hr.	
Failure Rate: $613 \times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 7 Number of Failures Reported: 0	MTBF (in hours): 1,631.3 Total Hours of Operation: 2,259.3 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Master Measuring Voltage Supply (5 vps)			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance:		Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 40M20002, 40M20881 component:

The Master Measuring Voltage Supply is a dc to dc converter used to convert 24 to 36 volts input to a precise 5 volts output. The output is used as a reference voltage for the telemetry transducers.

Power Rating: Input 24 to 36 volts, Output 5 volts

Weight: 1.5 lb

Dimensions: 5.875 x 3.281 x 8.062 in.

Three failures were reported on Unsatisfactory Condition Reports, one was reported on an Inspection Report.

SUMMARY SHEET

Nomenclature: Temperature Control Assembly

Drawing Numbers: 20M40061,
20M40147

Vendor: Barber Colman Co.

Saturn I Vehicle

Location: Instrument Unit

Estimated Design Life: 200 hr.

Failure Rate: $3,704 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 270

Total Number of Components
this Data Represents 8

Total Hours of Operation:
374

Total Number of
Failures Reported 0

Vehicle Equipment: X
Ground Equipment:

Nomenclature: Temperature Control Assembly

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)

DATA SHEET	
Nomenclature: Temperature Control Assembly	
Drawing Numbers: 20M40147	Vendor: Barber Colman Co.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 200 hr.	
Failure Rate: $19,011 \times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 4 Number of Failures Reported: 0	MTBF (in hours): 52.6 Total Hours of Operation: 72.9 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

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Nomenclature: Temperature Control Assembly			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Temperature Control Assembly	
Drawing Numbers: 20M40061	Vendor: Barber Colman Co.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 200 hr.	
Failure Rate: 4,590 x 10 ⁻⁶ /hr.	MTBF (in hours): 217.4
Number of Components this Data Represents: 4	Total Hours of Operation: 301.1
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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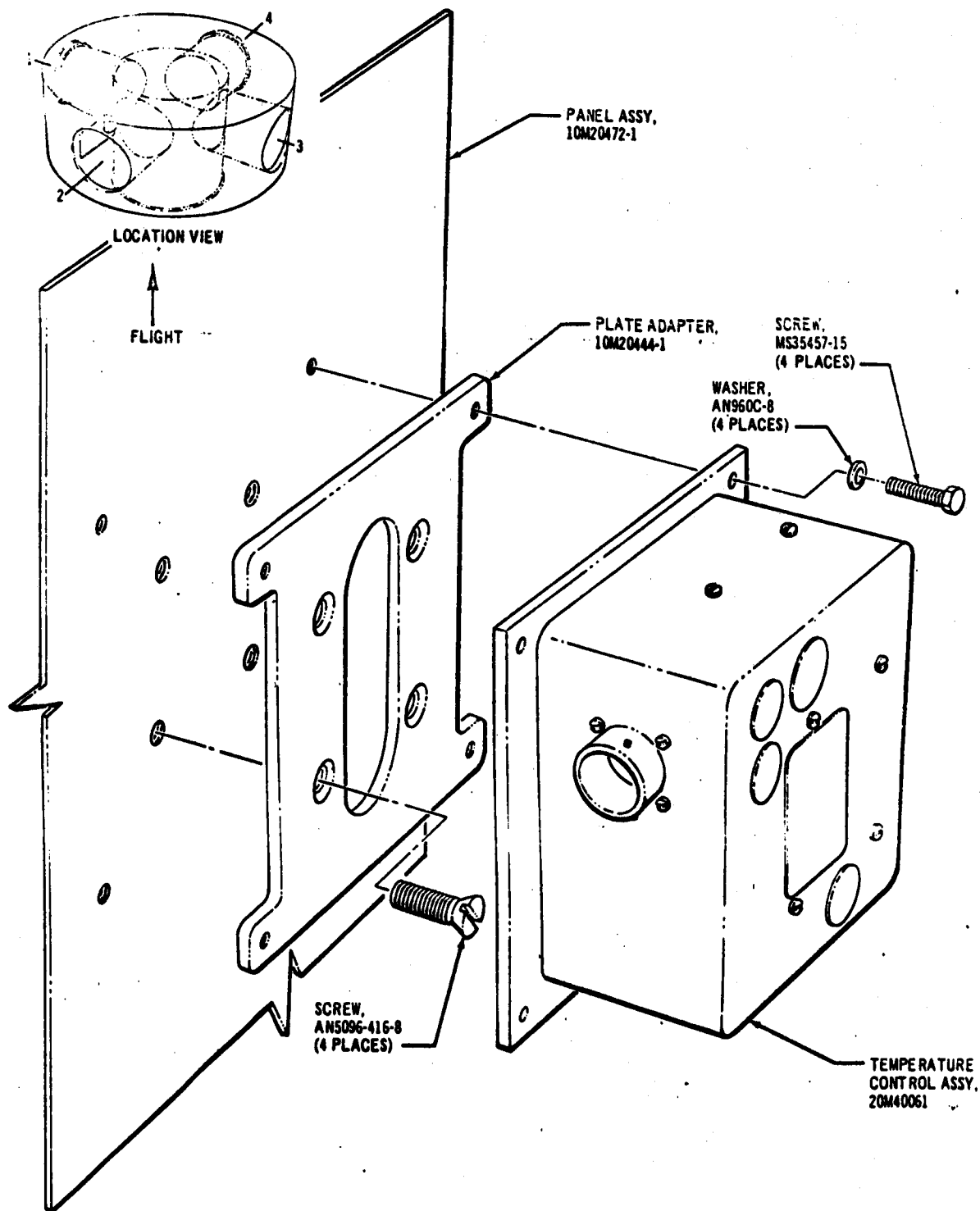
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Nomenclature: Temperature Control Assembly			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-5 through SA-7 Vehicles (less CALENDAR TIME DATA REPRESENTS: flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M40061 and 20M40147 component:

The temperature control assembly is used in conjunction with the temperature sensor to control the opening of the iris mixing valve.

1. Vendor - Barber Colman Co., Part No. SYLZ8434
2. Location - Tube No. 2 of instrument unit
3. Temperature - Operating: 0°F to plus 125°F
4. Electrical Characteristics -
 - a. Insulation resistance: 250-volt megger test from each connector pin to chassis; 50 megohms minimum
 - b. Voltage operating: 22 to 32 vdc with 28 vdc nominal and a maximum of 400 millivolts ripple



TEMPERATURE CONTROL ASSEMBLY, 20M40061 -
INSTALLATION VIEW

SECTION II

ELECTROMECHANICAL COMPONENTS

LIST OF COMPONENTS

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
II. Electromechanical Components		
II.1	<u>Valve, Main</u>	
II.1.1	LOX	403835
II.1.2	Fuel	405224
II.2	<u>Valve, Ignition Monitor</u>	
II.2.1	Engine	554838
II.3	<u>Valve, Cooling</u>	
II.3.1	Cooling	20M40002
II.3.2	Pre-Cooling	10417068 20M40205
II.4	<u>Valve, Fill and Drain</u>	
II.4.1	Fill and Drain (LOX)	10414002
II.4.2	Fill and Drain (Fuel)	10414352
II.5	<u>Valve, Mixing</u>	
II.5.1	Iris	10417100 10481703
II.6	<u>Valve, Fill and Vent</u>	
II.6.1	Fill and Vent (Bottle) and (Sphere)	10414030 20M30131
II.7	<u>Valve, Pre-Valve</u>	
II.7.1	LOX	10414005 20M30042 60C27830

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
II.7.2	Fuel	10414024 20M30043
II.8	<u>Valve, Vent</u>	
II.8.1	Solenoid Vent	20M30416 20M30488
II.8.2	Cooler Vent	20M40072
II.8.3	Fuel Vent	10414021 20M30000
II.8.4	LOX Vent	10414001 20M30122
II.9	<u>Valve, Shutoff</u>	
II.9.1	Shutoff 1/2 Inch	10417001
II.9.2	Shutoff 1 Inch	10481705
II.10	<u>Valve, Sequence</u>	
II.10.1	Fuel Igniter	403520
II.11	<u>Valve, Purge</u>	
II.11.1	Camera Lens	20M30419
II.11.2	Calorimeter Control	10414093 20M30160
II.11.3	LOX, SOX	60C27927
II.12	<u>Valve, Multi-Application</u>	
II.12.1	Multi-Application	10414027 20M30128 20M30380

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
II.13	<u>Valve, Replenishing</u>	
II.13.1	LOX	10414003 20M30045
II.14	<u>Valve and Orifice Assy</u>	
II.14.1	Assy	10414310 10414091 10414355
II.15	<u>Valve, Pressurization</u>	
II.15.1	Control	10414308 10414082 20M30171
II.15.2	Fuel	10414358
II.15.3	Fuel Level	10414055
II.15.4	Fuel Safety	10414039 20M30020
II.16	<u>Switch, Limit</u>	
II.16.1	LOX Level	10414095
II.16.2	Fuel Level	10414096
II.16.3	Limit Assy	10410747
II.17	<u>Switch, Pressure</u>	
II.17.1	Low OK	10414092 20M30159
II.17.2	Fuel Control	10414338 20M30184
II.17.3	LOX Control	10414340 20M30185

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
II.17.4	Step Pressure (LOX)	10414068 20M30144
II.17.5	Pressure	10414042 20M30135
II.17.6	High Pressure	10414029 20M30130
II.17.7	Step Pressure (Fuel)	10414081 20M30154
II.17.8	Thrust OK Pressure	10480716 20M50830 20M50242 60C27818 60C20278
II.17.9	Absolute Pressure	10414086 20M30415
II.18	<u>Accumulators</u>	
II.18.1	Reservoir	10415898 20M85008 20M85062
II.19	<u>Additive Blender Unit</u>	
II.19.1	Fuel	454075
II.20	<u>Motor</u>	
II.20.1	Hydraulic	10415248 20M85006 20M85065

DATA SHEET	
Nomenclature: Valve (Main LOX)	
Drawing Numbers: 403835 Saturn I Vehicle	Vendor: North American Aviation Location: S-I Stage
Estimated Design Life: 1,000 cy.	
Failure Rate: 4,995 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 43 Number of Failures Reported: 6	MCBF (in cycles): 200.2 Total Cycles of Operation: 1,201 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation , Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: No qualification data available			

Additional information concerning the 403835 valve:

Admits LOX to the thrust chamber and gas generator, opens and closes the main LOX valve using high pressure fuel as the medium..

Operating pressure: 900 psig (LOX)

Weight: 24.17 lb

NOTE: This component is purchased with a sequence fuel igniter valve No. 403520 installed/mounted on the 403835 valve, thus increasing its actual weight.

Six failures were reported on Inspection Reports.

DATA SHEET	
Nomenclature: Valve (Main Fuel)	
Drawing Numbers: 405224	Vendor: Rocketdyne Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 1,000 cy.	
Failure Rate: $4,011 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 249.3
Number of Components this Data Represents: 37	Total Cycles of Operation: 748*
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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* Minimum operation time. Serial No. R-01F
not shown in cycle logs.

II.1.2
Page 1 of 5

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish	<u>1</u>	Shorted:
<u>1</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		<u>Dead spot on</u>
	Sticking		<u>potentiometer</u>
	Would Not Open		_____
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

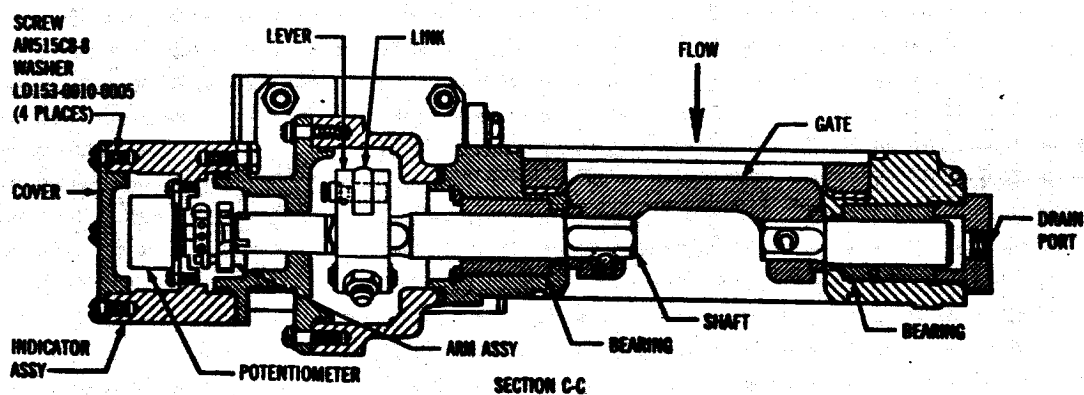
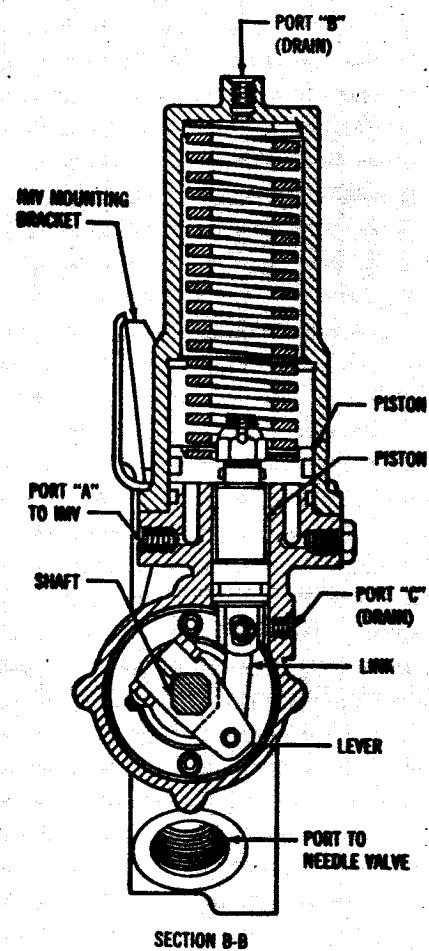
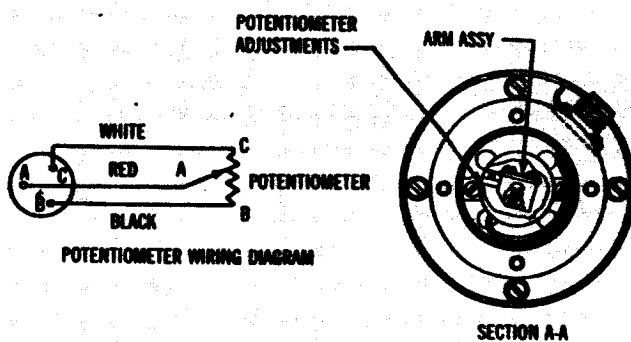
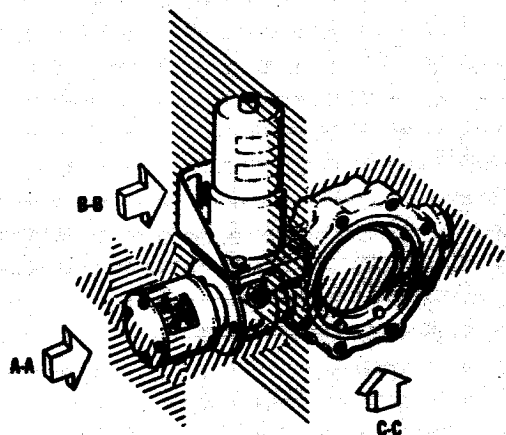
Additional information concerning the 405224 valve:

Three failures were reported on Inspection Reports.

MAIN FUEL VALVE, PART NO. 405224

The butterfly type, normally closed, main fuel valve controls the flow of fuel to the thrust chamber. When the fuel igniter valve is actuated it allows fuel pressure to flow to the ignition monitor valve (IMV). When a pressure of 28 psig is reached in the fuel injector manifold, fuel flows through the IMV into the opening port of the main fuel valve.

1. Vendor - Rocketdyne Division, North American Aviation, Inc., Part No. 405224
2. Location - Station 91
3. Service - RP-1 fuel
4. Pressure -
 - a. Valve actuation: 300 \pm 10 psig
 - b. Cracking: 155 \pm 30 psig
5. Lubrication -
 - a. Lubricate packings, O-rings, and gaskets with FS1280 grease per RA0112-002
 - b. Lubricate pin 9512-48427, pin 400334, and bearing 19-401130 with MIL-L-4343 grease
6. Leakage
 - a. Gate lip seal: 5 scim maximum at 30 to 500 psig
 - b. Shaft seals: 1 scim maximum at 300 psig
 - c. Actuator packings: 1 scim maximum at 500 \pm 50 psig at each port successively
7. Electrical Characteristics - Potentiometer and connector:
 - a. Resistance across pins A and C with valve closed
 - (1) Minimum: 45 ohms
 - (2) Maximum: 55 ohms
 - b. Resistance across pins A and C with valve open
 - (1) Minimum: None
 - (2) Maximum: 2200 ohms
 - c. Resistance across pins B and C
 - (1) Minimum: 1800 ohms
 - (2) Maximum: 2200 ohms



MAIN FUEL VALVE, 405224 - SECTIONAL VIEW



DATA SHEET	
Nomenclature: Valve (Engine Ignition Monitor)	
Drawing Numbers: 554838 Saturn I Vehicle	Vendor: North American Aviation Marotta Inc. Rocketdyne Inc. Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 14,970 $\times 10^{-6}$ /cy. Number of Components this Data Represents: 100 Number of Failures Reported: 24	MCEF (in cycles): 66.8 Total Cycles of Operation: 1,607 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	<u>Deactuation 5 sccm max. at vent port; actuation 2 sccm max. at vent port. No external leakage allowed at diaphragm cap.</u>
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

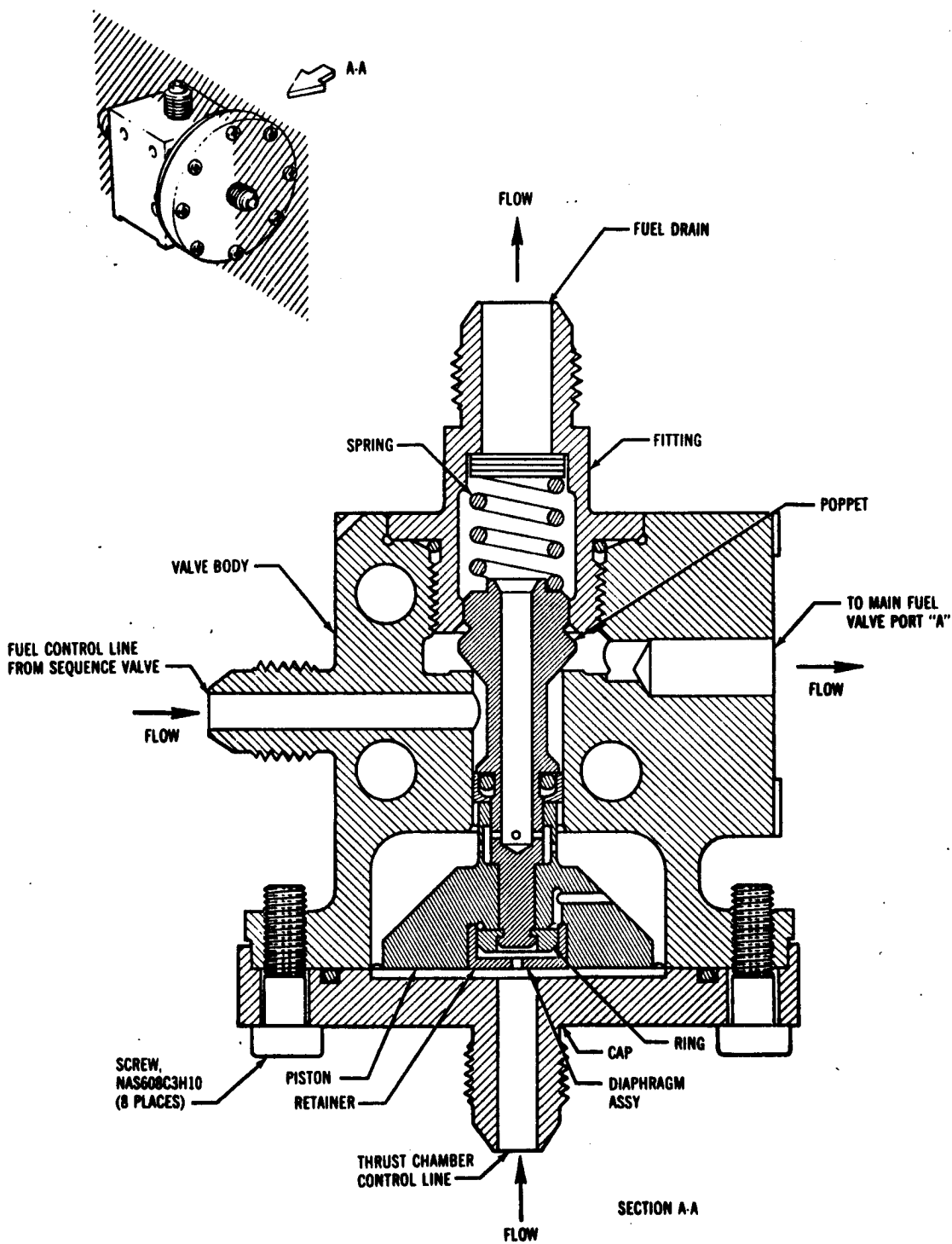
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out		Indicator Shows:
<u>4</u>	Erratic		No Open
<u>11</u>	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>6</u>	Out of Specs	<u>1</u>	Other: _____
	Oil/Moisture Saturation		<u>Incomplete shuttle</u>
<u>1</u>	Sticking		_____
	Would Not Open		_____
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-8 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-62-5, 21 February 62, MSFC			

Additional information concerning the Ignition Monitor Valve,
Part No. 554838

The ignition monitor valve, a three-way, pressure actuated valve, monitors satisfactory ignition before directing actuation pressure to open the main fuel valve. Pressure buildup sensed at the thrust chamber fuel injector manifold opens the ignition monitor valve allowing fuel pressure to open the main fuel valve.

1. Vendor - Rocketdyne Division, North American Aviation, Inc., Part No. 554838
2. Location - Attached to the main fuel valve at Station 88 on each engine
3. Service - RP-1 fuel
4. Pressure -
 - a. Actuation: 15 \pm 0.5 psig
 - b. Proof: 1600 \pm 50 psig
5. Lubrication - Lubricate all O-rings per RA0206-086 with DC-55 grease (Dow Corning). Lubricate fitting 554845 and screw threads NAS608C3-H-10 per RA0112-002 with DC-55 grease (Dow Corning)
6. Leakage -
 - a. Deactuation: 5 standard cubic centimeters per minute maximum at vent port
 - b. Actuation:
 - (1) 2 standard cubic centimeters per minute maximum at vent port
 - (2) No external leakage allowed at diaphragm cap

Twenty-two failures were reported on Inspection Reports, two were reported on Unsatisfactory Condition Reports.



IGNITION MONITOR VALVE, 554838 - SECTIONAL VIEW

DATA SHEET	
Nomenclature: Valve (Cooling 4")	
Drawing Numbers: 20M40002	Vendor: Whittaker Controls
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 5,000 cy.	
Failure Rate: $2,010 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 25 Number of Failures Reported: 0	MCBF (in cycles): 497.5 Total Cycles of Operation: 689 Vehicle Equipment: Ground Equipment: X
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray: <u>20% salt solution for 168 hours minimum</u>	
Shock:	
High Temperature: <u>4 hours at 160°F</u>	
Low Temperature: <u>4 hours at 0°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop): <u>6 shocks at 20 g for 10 milliseconds</u>	
Leakage Rate: <u>3 cycles with upstream pressure of 1.08[±]</u> <u>0.36 psig at flow rate of 60 ppm</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20 to 2000 cps for 10 min, from 2 to 10 g</u>	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report 62-806 May 18, 1962, Whittaker Controls and Guidance (Division of Telecomputing Corp.)			

Additional information concerning the 4" cooling valve component:
Drawing Number 20M40002

Environmental Qualification Tests Performed:

Proof Pressure: 22 psig for 10 min

Actuation: 2 cycles of open and close at 1.0 psig applied to the
inlet port with downstream restricted flow of 60 ppm

Insulation Resistance: at 500 vdc, results less than specs of
50 megohms minimum

Sand and Dust: Density of dust and sand at 0.1 to 0.5 grams
per cubic foot at maximum humidity of 30%

Life Cycle: 5000 cycles

Burst Pressure: 45 psig for 10 min

The valve is a motor actuated, butterfly shutoff valve for
a 4-inch tube size system. The valve is used in the space
environmental control system to modulate the flow of conditioned
air into the guidance and control compartment.

Requires a 28-volt power supply.

REV	DESCRIPTION	DATE	BY	CHKD
1	ISSUED FOR FABRICATION	1/25/78	W	W
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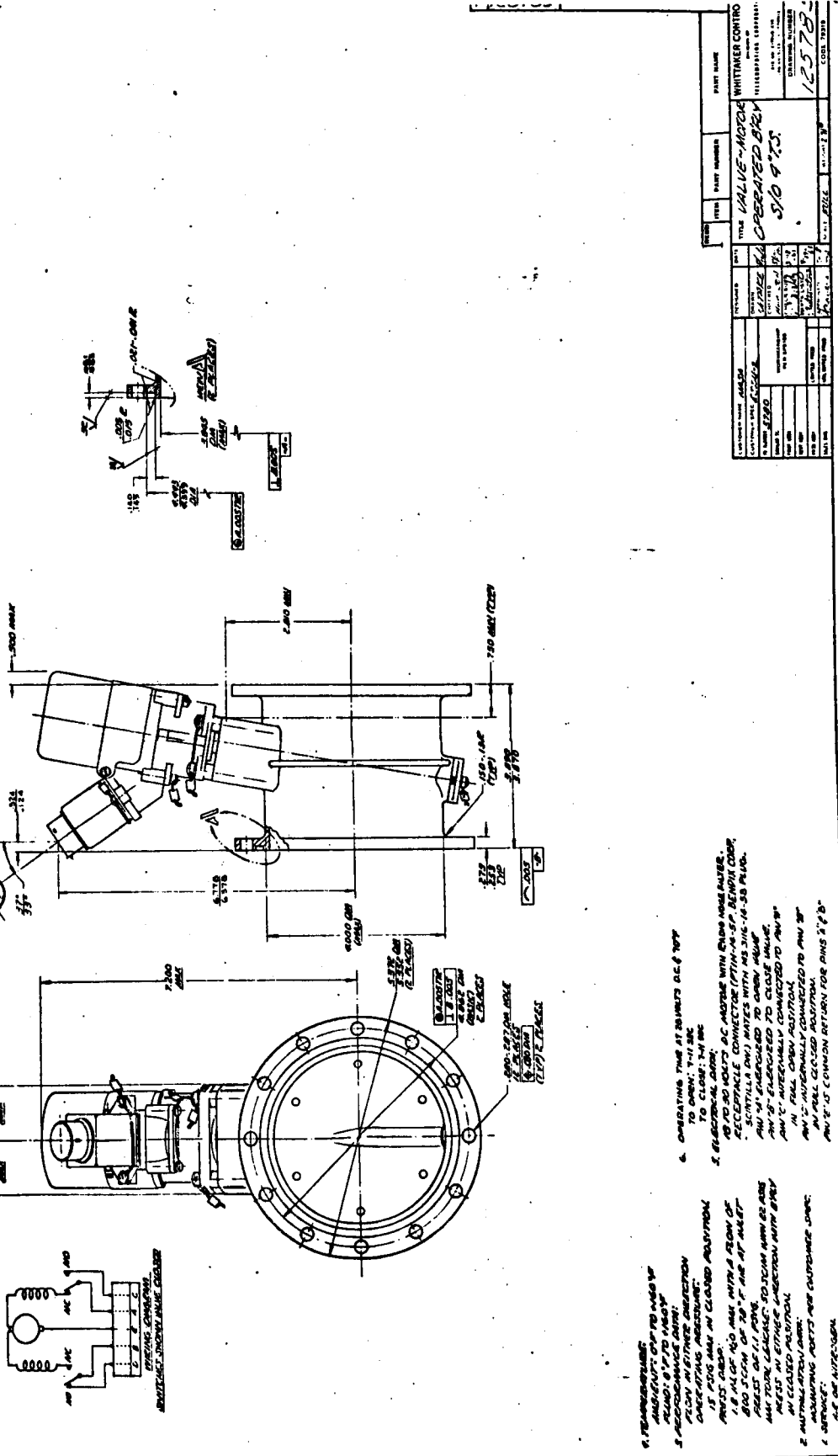
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SUMMARY SHEET	
Nomenclature Valve, (Pre-Cooling)	
Drawing Numbers: 10417068, 20M40205 Saturn I Vehicle	Vendor: NASA/MSFC Location: G.S.E.
Estimated Design Life: 150 cy.	
Failure Rate: $6,578 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 6 Total Number of Failures Reported: 1	MCBF (in cycles): 152 Total Cycles of Operation: 152 Vehicle Equipment: Ground Equipment: X

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valve (Pre-Cooling)	
Drawing Numbers: 10417068	Vendor: NASA/MSFC
Saturn I Vehicle	Location: G.S.E.
Estimated Design Life: 150 cy.	
Failure Rate: 55,555 $\times 10^{-6}/\text{cy.}$	MCBF (in cycles): 18
Number of Components this Data Represents: 2	Total Cycles of Operation: 26
Number of Failures Reported: 0	Vehicle Equipment: Ground Equipment: X
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Valve (Pre-Cooling)	
Drawing Numbers: 20M40205	Vendor: Not Available
Saturn I Vehicle	Location: G.S.E.
Estimated Design Life: 150 cy.	
Failure Rate: $7,936 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 4 Number of Failures Reported: 1	MCRP (in cycles): 126 Total Cycles of Operation: 126 Vehicle Equipment: Ground Equipment: X
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration; Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET

Nomenclature: Valve (fill and drain) LOX

Drawing Numbers: 10414002

Vendor: NASA/MSFC

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 2,000 cy.

Failure Rate: $28,248 \times 10^{-6}/\text{cy.}$

MGRF (in cycles): 35.4

Number of Components
this Data Represents: 22

Total Cycles of Operation: 1,455*

Number of
Failures Reported: 41

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:

Acceleration: 2 g for 1 minute, 16 g for 1 minute,
8 g for 1 minute

Altitude:

Radio Interference:

Salt Spray:

Shock:

High Temperature: 185° for 2 hours

Low Temperature: 0° for 2 hours

Ambient Room Temperature:

Thermal Shock: 35 g for 10 milliseconds (triangle
wave) or 35 g for 10 milliseconds (sine
Shock Impact (Flat Drop): wave) or 35 g for 6 milliseconds
(square wave)

Leakage Rate:

Humidity:

Random Noise:

Sine Wave Method: 20 to 2000 CPS for 10 min

Vibration: 20 - 55 cps at 5, 3, 3.8, 4.5, 5.3, and 6 g
55 - 100 cps at 0.03, 0.02, 0.024, 0.029, 0.034
and 0.039 in.
100 - 2000 cps at 20, 10, 12.5, 15 and 17.5 g

December 1965 (Revision)

* Minimum cycle. Three components not shown
in cycle logs (SN 182, 220, and 173).

II.4.1

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>37</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>1</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
<u>1</u>	Would Not Open		_____
<u>1</u>	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Chrysler Report MEP-M-37, June 28, 1961			

Additional information concerning the 10414002 valve:

Environmental Qualification Tests Performed:

Burst Pressure: 1,125 psig for 5 minutes

Forty-one failures were reported on Inspection Reports.

Leakage data showed the following:

24 failures where no leakage is allowed in the specs.

4 failures were from 2 to 50 cfm above specs.

3 failures were from 60 to 100 cfm above specs.

6 failures were more than 100 cfm above specs.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 19 April 1961
TITLE SATURN COMPONENT ASSEMBLY PROCEDURE 10414002 LOX FILL AND DRAIN VALVE ASSEMBLY		PROCEDURE EP-140
APPROVED <i>R. Ruff</i>		PAGE 1 of 4

1. DESCRIPTION.

The LOX fill and drain valve assembly 10414002 is a dual purpose normally closed poppet valve. The valve is opened for both the filling and draining operations by using its pneumatic override feature. The valve assembly is installed on the expansion joint in LOX container L3 as shown in the installation view. The various functional characteristics of the valve are as follows:

1.1 Pneumatic Override Characteristics. The pneumatic override feature is ground controlled to open the valve poppet for either filling or draining the LOX container. When the valve poppet is fully open, the electrical circuit of the indicator switch is opened to indicate to the blockhouse that the valve has opened. The pneumatic override feature of the valve is capable of performing as follows:

- a. Minimum operating pressure: 500 p.s.i.g.
- b. Nominal operating pressure: 750 p.s.i.g.
- c. Proof operating pressure: 1,125 p.s.i.g.
- d. Burst pressure (without bursting): 1,875 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
- e. Operating temperature range: Minus 320° to plus 125° F.
- f. Leakage past control cylinder: 50 c.i.m. maximum of helium at a pressure of 750 \pm 5 p.s.i.g.
- g. Poppet travel: 1.552-inches minimum.

1.2 Poppet Seat and Switch Connector Leakage Requirements. The poppet seat pneumatic and liquid and the switch connector liquid leakage requirements are as follows:

- a. Poppet seat pneumatic leakage: 100 s.c.i.m. maximum as measured downstream of the poppet with the valve pressurized to 80 \pm 1 p.s.i.g. of helium at the retainer end of the poppet.
- b. Poppet seat and retainer liquid leakage: No leakage with valve closed and 80 \pm 1 p.s.i.g. liquid nitrogen pressure applied to the external side of the poppet.
- c. Switch connector liquid leakage: No leakage, as evidenced by the presence of liquid or frosting at the connector, with valve poppet open and 80 \pm 1 p.s.i.g. liquid nitrogen flow.

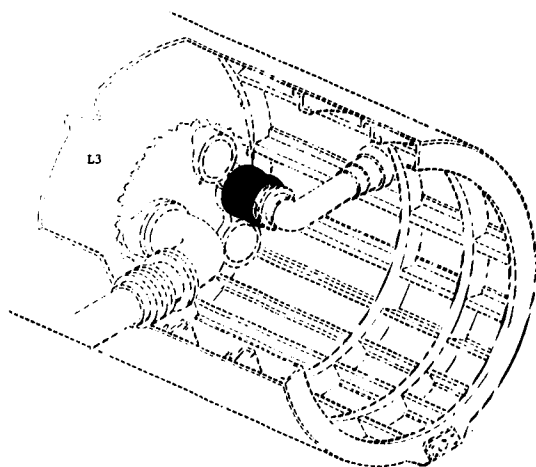
1.3 Electrical Performance Characteristics. The switch assembly indicates that the valve is closed when the poppet is within 0.070-inch maximum and 0.005-inch minimum of its seated position. A continuity check between electrical connector pins "A" and "B", pin "A" and the valve body, and pin "B" and the valve body with the valve in the closed position must indicate less than 15 ohms resistance. With the valve in the open position the insulation resistance between electrical connector pin "A" and the valve body, pin "B" and the valve body, and pins "A" and "B" must be a minimum of 50 megohms.

REVISION DATE

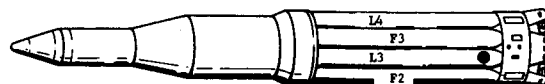
27 APR 1962

Continued on Page 4)

10414002



INSTALLATION VIEW - LOOKING FORWARD



GENERAL LOCATION

== LEGEND ==

10414002	LOX FILL AND DRAIN VALVE ASSEMBLY ("C" REV. EO-3 & -4) (A) (B) (C)	18.	AN814-8DL	SCREW THREAD PLUG AND BLEEDER (Q) (H)
1.	MS20995C41	19.	8941661	SPRING ("C" REV.)
2.	8944184	20.	8944179	SHAFT ("C" REV.)
3.	8944192	21.	10414324	PISTON (R)
4.	8944183	22.	MS28778-6	PREFORMED PACKING (O-RING) (J) (K)
5.	8944182	23.	10414325	SWITCH ASSEMBLY (R)
6.	8944181	24.	8944043	LIPSEAL ("B" REV.)
	10414238	25.	8944187	CYLINDER ("B" REV.) (S) (H)
		26.	8944265	GASKET (EO-1) (T)
		27.	8944188	MUT (U) (H)
		28.	10414330	SEAL SUPPORT
7.	8944200	29.	8945333	CHEVRON SEAL
8.	8944207	30.	8945334	SEAL RETAINER
9.	8945450	31.	8944189	LOCKNUT (V)
10.	8944075	32.	10414332	SPECIAL THERMOCOUPLE GLAND (EO-1A & -2A) (CONAX CORP. AN-MTG-SPECIAL, DWG. EL 5714) (W) (H) (U)
11.	10414389			ELECTRICAL WIRING (STRANDED COPPER AWG NO. 20, MIL 3861, TYPE B, CLASS 0, COATED) (X)
12.	10414591			TUBING (SUPRENT MFG. CO. NO. TT-6) (K)
13.	20M00420-4			
		33.		
14.	8942983			
15.	20M00420-6			
		34.	10414260	
16.	10414327			
17.	20M00420-8			

== NOTES ==

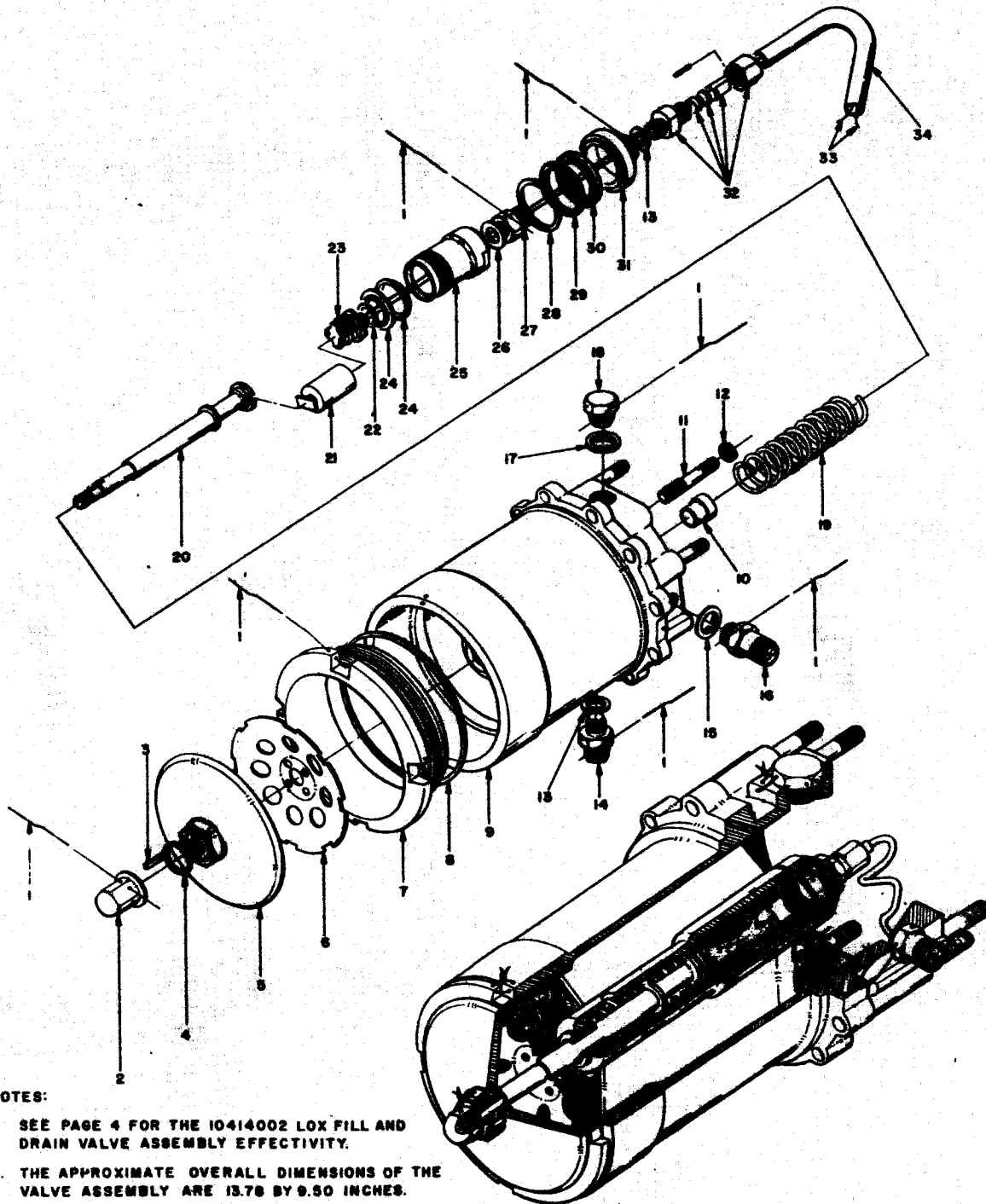
- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (E) LUBRICATE ALL SLIDING SURFACES AND SEALS WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE 2 POWDER OR APPROVED EQUIVALENT. BLOW OFF EXCESS LUBRICANT WITH DRY NITROGEN GAS.
- (F) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (G) TORQUE 225 TO 250 INCH-POUNDS
- (H) APPLY AR-1F FITTING SEALANT GREASE TO FIRST THREE EXTERNAL THREADS ONLY.
- (J) LUBRICATE BOTH SIDES WITH M. W. KELLOGG CO. KEL-F-10 POLYMER OIL OR APPROVED EQUIVALENT.
- (K) OR APPROVED EQUIVALENT.
- (L) TORQUE 1,800 TO 2,400 INCH-POUNDS.
- (M) TORQUE 130 TO 180 INCH-POUNDS.
- (N) TORQUE 365 TO 475 INCH-POUNDS.
- (P) SOLDER THE WIRE IN BLACK TUBING TO THE "B" TERMINAL OF THE CONNECTOR. SOLDER WIRE IN WHITE TUBING TO THE "A" TERMINAL. SOLDER THE CONNECTIONS IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300 WITH SOLDER CONFORMING TO SPEC. QQ-S-571C/SN60. AFTER SOLDERING, TRIM TUBING 10414260 AS CLOSE TO CONNECTOR AS POSSIBLE.
- (Q) TORQUE 500 TO 700 INCH-POUNDS.
- (R) IF THE INDICATING SWITCH IN THE PISTON DOES NOT INDICATE THAT THE VALVE IS CLOSED WHEN THE POPPET IS WITHIN 0.070-INCH (MAXIMUM) AND 0.005-INCH (MINIMUM) OF ITS SEATED POSITION, COUNTERBORE THE PISTON SUFFICIENTLY TO BRING THE VALVE WITHIN LIMITS.
- (S) TORQUE 200 TO 300 INCH-POUNDS.
- (T) COVER WITH AR-1F.
- (U) TORQUE 150 TO 200 INCH-POUNDS.
- (V) TORQUE 375 TO 425 INCH-POUNDS.
- (W) TORQUE 140 TO 165 INCH-POUNDS.
- (X) BEFORE INSERTING INTO GLAND ASSEMBLY, TIN THE SWITCH WIRES FOR A SUFFICIENT LENGTH TO ALLOW THE GLAND GASKET TO REST IN A COMPLETELY TINNED AREA. THE TINNED AREA OF THE WIRE MUST HAVE A SMOOTH SURFACE.

DRAWN BY:	<i>A. Bette</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414002	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. H. Bennett</i>		EO'S	-3 and -4	
WRITER:	<i>A. L. Schenck</i>				
APPROVED BY:	<i>M. Schuster</i>		CONTROL NO.	<i>II-4-1</i>	9 Feb 1962

MANUFACTURING PLAN

PROCEDURE EP-140

PAGE 3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 10414002 LOX FILL AND DRAIN VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 13.78 BY 9.50 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 18.30 POUNDS.

REVISION DATE: 9 FEB 1962

FBAE-EP140-410-8 10414002

MSFC - Form 1151-3 (June 1961)

MANUFACTURING PLAN

CAUTION: Paragraphs 1.4 and 1.5 constitute destruction test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes.

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at three g's,
55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10419929 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Federal - QQ-S-571/SN60
NASA - MSFC-SPEC-106
Military - MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33540
MS33586
Army Ballistic Missile Agency
AMBA-STD-18
ABMA-STD-41

3.3 Drawings:

Ordnance Corps - 10419929
10509300
10509305

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"C" Rev. and EO-3 and -4
SA-1	"C" Rev. and EO-3
SA-2	"C" Rev. and EO-3 and -4
SA-3	"C" Rev. and EO-3 and -4
SA-4	"C" Rev. and EO-3 and -4
SPARES	Before installing modify to latest configuration

10414002

REVISION DATE 9 FEB. 1962

DATA SHEET	
Nomenclature: Valve (fill and drain) Fuel	
Drawing Numbers: 10414352	Vendor: NASA/MSFC
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 7,288 x 10 ⁻⁶ /cy.	MCEF (in cycles): 137.2
Number of Components this Data Represents: 20	Total Cycles of Operation: 686
Number of Failures Reported: 5	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>2 g for 1 minute, 16 g for 1 minute,</u> <u>8 g for 1 minute</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>185° for 2 hours</u>	
Low Temperature: <u>0° for 2 hours</u>	
Ambient Room Temperature:	
Thermal Shock:	<u>35 g for 10 milliseconds (triangle</u> <u>wave) or 35 g for 10 milliseconds</u>
Shock Impact (Flat Drop):	<u>(sine wave) or 35 g for 6 milliseconds</u> <u>(square wave)</u>
Leakage Rate:	
Humidity: <u>68 to 168°F for 240 hours at 95% RH</u>	
Random Noise:	
Sine Wave Method:	<u>20 to 2000 cps for 10 min</u>
Vibration:	<u>20 - 55 CPS at 5, 3, 3.8, 4.5, 5.3, and 6 g</u> <u>55 - 100 cps at 0.03, 0.02, 0.024, 0.029, 0.034</u> <u>and 0.039 in.</u> <u>100 - 2000 cps at 20, 10, 12.5, 15 and 17.5 g</u>

December 1965 (Revision)

II.4.2
Page 1 of 8

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>1</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Chrysler Report MEP-M-37, June 28, 1961			

Additional information concerning the 10414352 valve:

The valve has a switch assembly indicating valve closure when the poppet is within 0.040-in. maximum and 0.005-in. minimum of its seated position.

Environmental Qualification Tests Performed:

Burst Pressure: 1,125 psig for 5 min

The five failures were reported on Inspection Reports.

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MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414352 FUEL FILL AND DRAIN VALVE ASSEMBLY				11 July 1961	EP-140
				APPROVED <i>R. Post</i>	PAGE 1 of 4

1. DESCRIPTION.

The fuel fill and drain valve assembly 10414352 is a dual purpose normally closed poppet type valve. The valve is opened for both the filling and draining operation by using its pneumatic override feature. The valve assembly is installed between the fuel fill and transfer elbow and the flex line in container F1 as shown in the installation view. The various functional characteristics of the valve are as follows:

1.1 Pneumatic Override Characteristics. The pneumatic override feature is ground controlled to open the valve poppet for either filling or draining the fuel container. When the valve poppet is fully open, the electrical circuit of the valve position indicator switch is opened to indicate to the blockhouse that the valve has opened. The pneumatic override feature of the valve is capable of performing as follows:

- a. Minimum operating pressure: 500 p.s.i.g. internal pneumatic pressure.
- b. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- c. Proof operating pressure: 1,125 p.s.i.g. internal pneumatic pressure.
- d. Burst pressure (without rupture): 1,875 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Operating temperature range: -65° to +125° F.
- f. Leakage past control piston assembly: 5 s.c.i.m. with 750 p.s.i.g. internal pneumatic pressure applied.

1.2 Flow Chamber Characteristics. The flow chamber characteristics are as follows:

- a. Operating medium: RP-1 fuel.
- b. Proof operating pressure: 100 p.s.i.g. minimum.
- c. Nominal operating pressure: 65 p.s.i.g. minimum.
- d. Burst pressure (without rupture): 165 p.s.i.g. minimum. (CAUTION: Use only for destructive acceptance testing.)
- e. Leakage past poppet seat: 10 s.c.i.m. maximum when the retainer end of the poppet is pressurized to 65 p.s.i.g. with pneumatic pressure.
- f. External leakage from the flow chamber with 65 p.s.i.g. pneumatic pressure applied: None.

1.3 Electrical Performance Characteristics. The switch assembly indicates that the valve is closed when the poppet is within 0.040-inch maximum and 0.005-inch minimum of its seated position. A continuity check between electrical connector pins "A" and "B" with the valve in the closed position must indicate less than 15 ohms resistance. With the valve in the open position the insulation resistance between electrical connector pin "A" and the valve body, pin "B" and the valve body, and pins "A" and "B" must be a minimum of 50 megohms.

REVISION DATE

27 APR 1962

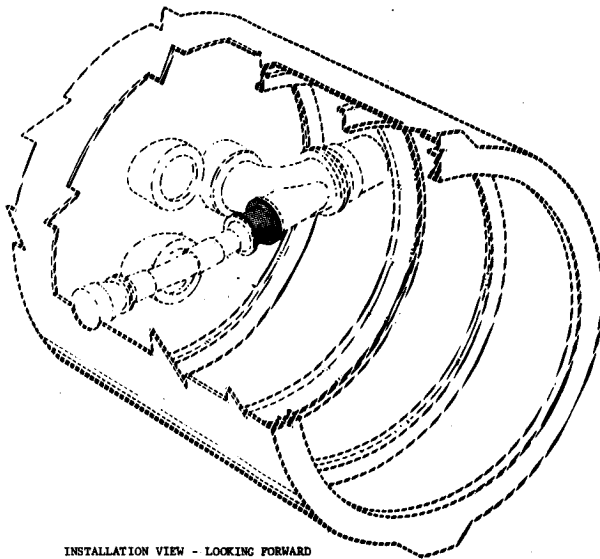
(Continued on page 4)

10414352

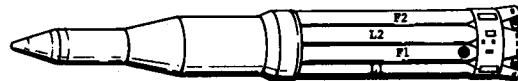
MSFC - Form 1151 (June 1961)

II.4.2

Page 5 of 8



INSTALLATION VIEW - LOOKING FORWARD



GENERAL LOCATION

==LEGEND (CON.)==

- | | | | |
|-----|--------------|---|---------|
| 7. | 8944299 | BODY (B) (E) (L) (M) | |
| 8. | 10414331 | BUSHING (SEE EO-1-10414541) | (N) (C) |
| 9. | MS29512-8 | PREFORMED PACKING (O-RING) | (P) (C) |
| 10. | 10414577 | BUSHING (EO-1A) | (P) (C) |
| 11. | MS29512-4 | PREFORMED PACKING (O-RING) | (P) (C) |
| 12. | 10414578 | ADAPTER (C) (C) | |
| 13. | 10414267 | VENT SEAL (R) | |
| 14. | 10414294 | GASKET (RAYBESTOS MANHATTAN INC., K-66) | |
| 15. | 8944216 | CONNECTOR ("A" REV.) (CANNON ELECTRIC CO., CS02-10SL-4P-111) | (P) (S) |
| 16. | MS35276-14 | SCREW (4 PLACES) | |
| 17. | MS2095C20 | LOCKWIRE (E) | |
| 18. | MS29512-6 | PREFORMED PACKING (O-RING) (SEE EO-1A-10414352) | (P) (C) |
| 19. | AN814-6DL | SCREW THREAD PLUG AND BLEEDER (SEE EO-1A-10414352) | (C) (T) |
| | 10414540 | ORIFICE UNION ASSEMBLY (U) | |
| 20. | 10414544 | MODIFIED UNION (MAKE FROM AN815-4C) | |
| 21. | 10414326 | UNION ORIFICE | |
| 22. | 10414592 | ELBOW (MAKE FROM AN833-4D) | |
| 23. | 10413826-258 | TUBE ASSEMBLY ("B" REV. AND EO-4) | (V) |
| 24. | 8944221 | SPRING ("A" REV.) | |
| 25. | MS29513-218 | PREFORMED PACKING (O-RING) | (F) (C) |
| 26. | 8944222 | SHAFT ("D" REV.) | (C) (M) |
| 27. | 10414328 | SWITCH ASSEMBLY (EO-1) | |
| 28. | MS29512-20 | PREFORMED PACKING (O-RING) | (P) (C) |
| 29. | 10414580 | ADAPTER (MAKE FROM 8944227, "B" REV.) | (X) |
| 30. | 10414332 | SPECIAL THERMOCOUPLE GLAND (EO-1A & 2A) (CONAX CORP. AN-MTG-SPECIAL, DMC, EL 5714) | (P) (T) |
| 31. | MS29513-21 | PREFORMED PACKING (O-RING) | (P) (C) |
| 32. | 10414576 | GLAND HOUSING (Z) | |
| 33. | 10414593 | UNION (MAKE FROM 8944360 "A" REV. WHICH IS MADE FROM AN815-4D) | (C) |
| 34. | | ELECTRICAL WIRING (STRANDED COPPER AWG NO. 20, MIL-W-3861, TYPE B, CLASS O, COATED) | (AA) |

NONFLIGHT ITEMS - FOR SHIPPING ONLY

- | | |
|-------------|------------------------|
| 8945476 | GASKET (2 REQUIRED) |
| 10414581 | SHIPPING GUARD (EO-1A) |
| MS35224-97 | SCREW (4 REQUIRED) |
| MS20365-324 | NUT (4 REQUIRED) |

==LEGEND==

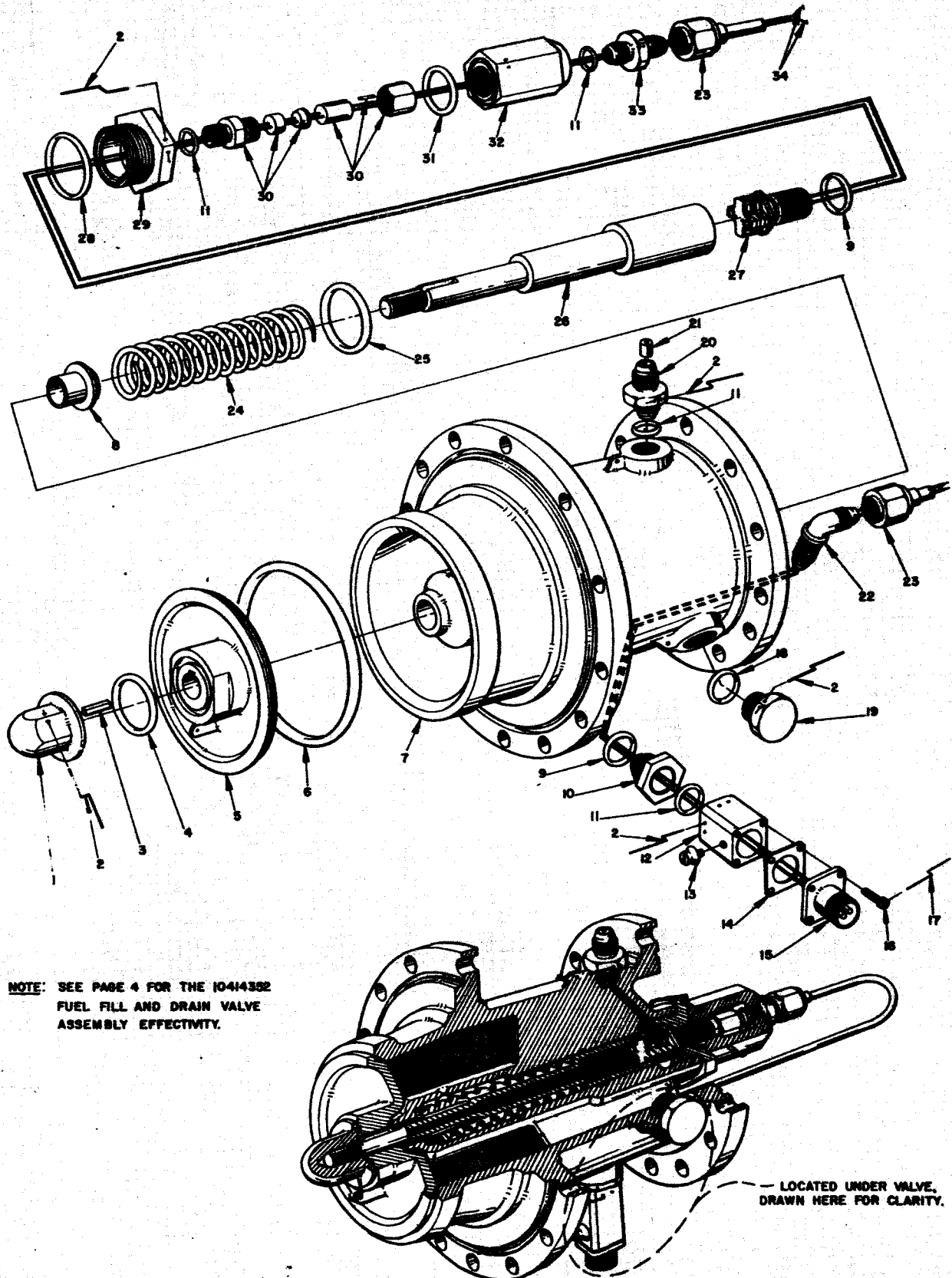
- | | | |
|----------|---|--|
| 10414352 | FUEL FILL AND DRAIN VALVE ASSEMBLY (EO-1A, -2 & -3) | (A) (B) (C) |
| 1. | 8944224 | ACORN NUT ("A" REV.) (D) |
| 2. | MS2095C41 | LOCKWIRE (E) |
| 3. | 8944223 | KEY |
| 4. | MS29513-212 | PREFORMED PACKING (O-RING) (F) (C) |
| | 8944238 | FUEL FILL AND DRAIN VALVE POPPET ASSEMBLY ("A" REV.) |
| 5. | 8944171 | POPPET ("B" REV.) (H) |
| 6. | 8944237 | SEAL (J) |
| | 10414583 | FUEL FILL AND DRAIN VALVE BODY ASSEMBLY (EO-1A) (MAKE FROM 10414541, EO-1) |

==NOTES==

- | | | |
|--|--|--|
| (A) CLEAN AND CONDITION ALL METALLIC AND NON-METALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305. | (L) HYDROSTATICALLY TEST THE OVERSIDE CYLINDER AT 1,125 P.S.I.G., AND PNEUMATICALLY TEST AT 750 P.S.I.G. UNDER WATER. THE APPEARANCE OF ANY BUBBLES DUE TO CASTING IMPERFECTIONS CONSTITUTES CAUSE FOR REJECTION. | (T) TORQUE 315 TO 475 INCH-POUNDS. |
| (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130. | (M) HYDROSTATICALLY TEST FOR SURGE PRESSURE IN COMBINATION WITH THE POPPET ASSEMBLY 8944238 AT 270 P.S.I.G. FOR 30 SECONDS ON THE POPPET SIDE OF THE LARGE DIAMETER FLANGE ONLY. NO PERMANENT DEFORMATION IS PERMISSIBLE. | (U) TORQUE 135 TO 150 INCH-POUNDS. |
| (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311. | (N) COOL TO MINUS 250° TO MINUS 300° F. AND INSERT IN PLACE. | (V) TORQUE TUBE ASSEMBLY NUTS 70 TO 120 INCH-POUNDS. |
| (D) TORQUE 225 TO 250 INCH-POUNDS. | (P) AN OPTIONAL METHOD OF MANUFACTURE IS MAKE FROM AN815-8C UNION. | (W) MALCOMIZE AS REQUIRED. |
| (E) LOCKWIRE IN ACCORDANCE WITH MS33540. | (Q) TORQUE 70 TO 120 INCH-POUNDS. | (X) TORQUE 140 TO 150 INCH-POUNDS AND LOCKWIRE TO HOUSING RIB. |
| (F) OR APPROVED EQUIVALENT. | (R) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER FLANGE CONTACTS THE ADAPTER. | (Y) TORQUE 140 TO 165 INCH-POUNDS. |
| (G) LUBRICATE WITH DOW CORNING CORP. FLOURO-SILICONE GREASE, QC-2-0026, OR APPROVED EQUIVALENT. | (S) SOLDER THE SWITCH ASSEMBLY WIRE INSULATED IN BLACK TUBING TO TERMINAL B AND THE WIRE INSULATED IN WHITE TUBING TO TERMINAL A IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300 WITH SOLDER CONFORMING TO SPEC. QQ-B-371C/1960. SEAL THE SOLDERED CONNECTION WITH POTTING COMPOUND, MINNESOTA MINING AND MANUFACTURING CO. SOLDER CAST NO. 212, OR APPROVED EQUIVALENT, MAKING CERTAIN THAT ALL UNWELDED ELECTRICAL WIRING IS COATED. MIX THE POTTING COMPOUND IN ACCORDANCE WITH THE APPLICABLE WORK SHEETS. | (Z) TORQUE 70 TO 80 INCH-POUNDS. |
| (H) RADIOGRAPHICALLY INSPECT PRIOR TO MACHINING IN ACCORDANCE WITH ABMA-STD-41, GRADE II. | | (AA) BEFORE INSERTING INTO THEIR RESPECTIVE INSULATION TUBING (MIL-I-7444, TYPE III), TIN THE WIRES FOR A SUFFICIENT LENGTH TO INSURE THAT THE GLAND GASKET RESTS IN A COMPLETELY TINNED AREA. THE TINNED AREA OF THE WIRE MUST HAVE A SMOOTH SURFACE. |
| (J) MOLD AND CURE IN PLACE (RUBBER, MIL-R-3065B, GRADE SB-715, A1B1E5 Buna N). | | |
| (K) HYDROSTATICALLY TEST THE FLOW CHAMBER AT 75 P.S.I.G. BOTH BEFORE AND AFTER MACHINING. PNEUMATICALLY TEST AT 25 P.S.I.G. UNDER WATER. THE APPEARANCE OF ANY BUBBLES DUE TO CASTING IMPERFECTIONS CONSTITUTES CAUSE FOR REJECTION. | | |

DRAWN BY:	<i>J. Bette</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414352	REVISION DATE OF THIS PAGE
PLANNER:	<i>W. B. Bennett</i>		EO'S -1A, -2, and -3	
WRITER:	<i>A. E. Schmitt</i>			
APPROVED BY:	<i>M. P. Schmitt</i>		ART CONTROL NO. M-MS-EP140- 451-C	27 Apr 1962

MANUFACTURING PLAN

PROCEDURE
EP-140PAGE
3 OF 4

NOTE: SEE PAGE 4 FOR THE 10414352
FUEL FILL AND DRAIN VALVE
ASSEMBLY EFFECTIVITY.

REVISION DATE:

M-F & A. 40-461

10414352

Form 1151-2 (June 1961)

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 3 g's,
55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10419937 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications.

Federal - QQ-S-571/SN60
Military - MIL-E-5272
MIL-I-7444
MIL-Q-9858
MIL-R-3065B
MIL-W-3861

3.2 Standards.

Military - MIL-STD-18
MIL-STD-41
MIL-STD-130
MIL-STD-643
MS29512
MS33540
MS33586

3.3 Drawings.

Ordnance Corps - 10419937 10509305
10509300 10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	EO-1A and -2
SA-1	EO-1A and -2
SA-2	EO-1A and -2
SA-3	EO-1A, -2, and -3
SA-4	EO-1A, -2, and -3
SPARES	Before installing modify to latest configuration

10414352

REVISION DATE 27 APR 1962

MSFC - Form 1151-1 (June 1961)

SUMMARY SHEET

Nomenclature Valve (Iris Mixing)

Drawing Numbers: 10417100,
10481703

Vendor: Lundy Corp.

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 2,000 cy.

Failure Rate: $5,770 \times 10^{-6}/\text{cy.}$

MCBF (in cycles): 173.3

Total Number of Components
this Data Represents: 40

Total Cycles of Operation:
1040

Total Number of
Failures Reported: 6

Vehicle Equipment: X
Ground Equipment: X

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out	<u>1</u>	Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
<u>1</u>	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>3</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 vehicles (less flight data)			

DATA SHEET	
Nomenclature: Mixing Valve (Iris)	
Drawing Numbers: 10417100	Vendor: Lundy Corp.
Saturn I Vehicle	Location: Umbilical Cord
Estimated Design Life: 2,000 cy.	
Failure Rate: 2,137 $\times 10^{-6}/\text{cy.}$	MCBF (in cycles): 468
Number of Components this Data Represents: 23	Total Cycles of Operation: 468
Number of Failures Reported: 1	Vehicle Equipment: Ground Equipment: X
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>2 g at 20 - 50 cps, 10 g at 110 - 2000 cps.</u>	
Vibration: <u>0.016 in. DA at 50 - 110 cps</u>	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report IN-P&VE-E-62-5, January 21, 1962			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		PROCEDURE
TITLE	DATE	PROCEDURE
SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10417100 4.00-INCH IRIS MIXING VALVE	2 June 1962	EP-140
	APPROVED <i>[Signature]</i>	PAGE 1 of 4

1. DESCRIPTION.

The 4.00-inch iris mixing valve is a motor operated modulating valve. The mixing valve is a component of the external cooling system and is used to vary the air flow within the external cooling package from full cooling to full by-pass, or to an intermediate position, as required to maintain a stable temperature. The mixing valve is located on the external cooling package bracket assembly 10481718 in the external cooling package assembly 10417098 mounted atop the tall cable mast as shown in the installation view. The various functional characteristics of the mixing valve are as follows:

1.1 Mechanical Performance Characteristics. The mixing valve is capable of performing mechanically as follows:

- a. Operating media: Air or gaseous nitrogen.
- b. Nominal operating pressure: 18 inches of H₂O.
- c. Proof pressure: 36 inches of H₂O.
- d. Burst pressure (without bursting): 72 inches of H₂O (CAUTION: Use only for destructive acceptance testing.)
- e. Operating temperature range: -65° to +125° F.
- f. Storage temperature: -80° to +125° F.
- g. Flow rate: 24 lb./min. of air at 15 inches of H₂O through each opening.
- h. Actuation time: Valve is capable of full traverse in either direction (open to by-pass or by-pass to open) in 11 ± 2 seconds. Time is measured from signal on to signal off.
- i. Distance from edge of iris blades to center post rubber washer: .04 \pm .01 dimension must be met, as shown in detail "A" on page 2.
- j. External leakage (outlet ports capped): 4.5 s.c.f.m. maximum when pressurized through the inlet port with air or GN₂ to 27 inches of H₂O.

1.2 Electrical Performance Characteristics. The mixing valve is capable of performing electrically as follows:

- a. Operating voltage range: 18 to 30 v.d.c.
- b. Maximum operating current of actuator: 2 a. at 27 v.d.c.
- c. Insulation resistance: 50 megohms minimum at 500 v.d.c. between each pin and the valve housing.
- d. Potentiometer resistance: Port "A" open - 0 to 200 ohms between pins "A" and "B", 4,750 to 5,050 ohms between pins "B" and "C". Port "B" open - 4,750 to 5,050 ohms between pins "A" and "B", 0 to 200 ohms between pins "B" and "C".
- e. Potentiometer resolution: 1/2 percent minimum.
- f. Potentiometer overshoot: 2 percent (100 ohms) maximum allowable.
- g. The wiring diagrams are shown on page 3.

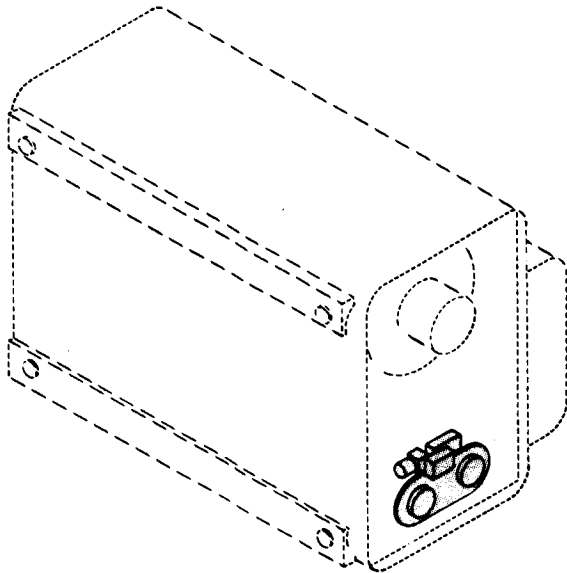
1.3 Life Cycle. The mixing valve is capable of completing 5,000 cycles minimum with an internal temperature of -65° F. without damage or impairment of performance.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

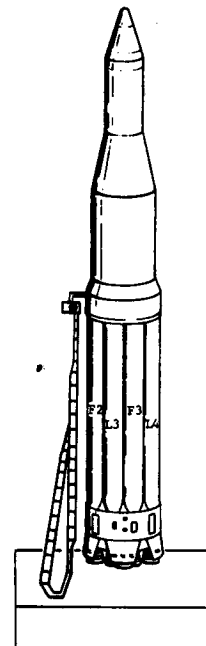
REVISION DATE

(Continued on page 4)

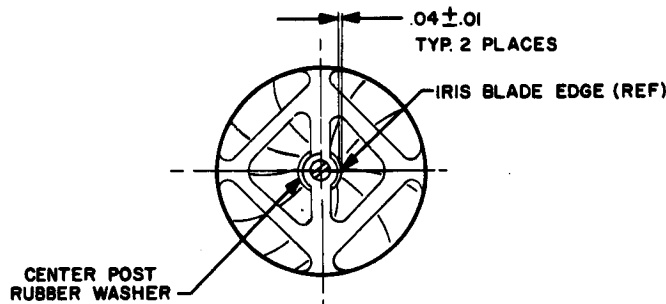
10417100



INSTALLATION VIEW - PRECOOLING
PACKAGE NON FLIGHT ITEM



GENERAL LOCATION



DETAIL A- MIXING BLADES ADJUSTMENT
(TYPICAL FOR BOTH PORTS "A" & "B")

NOTES

- (A) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (B) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (C) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (D) OR APPROVED EQUIVALENT.
- (E) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (F) LUBRICATE O-RINGS WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE 2 OR APPROVED EQUIVALENT.

LEGEND

10417100 4.00-INCH IRIS MIXING VALVE ("A" REV.)
(LUNDY MANUFACTURING CORP., LGA-M-44F-3)
(A) (B) (C) (D) (E) (F)

DRAWN BY:	B. Dennis	ENGINEERING DRAWING RELEASE	REVISION TO:	10417100	REVISION DATE OF THIS PAGE
PLANNER:	W. E. Bennett	A	EO'S		
WRITER:	W. W. Franklin		ART CONTROL NO.	M-ME-EP140-753	
APPROVED BY:	M. Skelton				

MSFC - Form 1151-1 (June 1961)

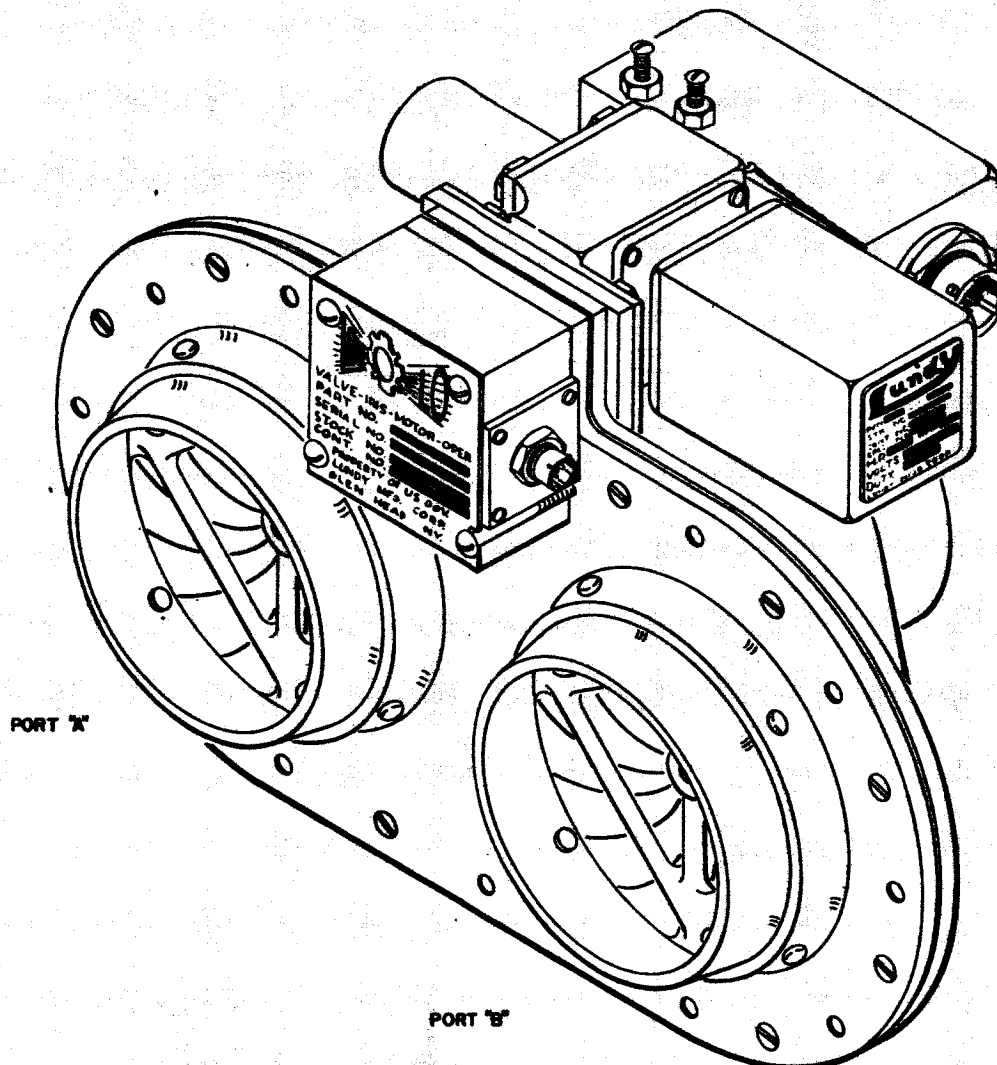
MANUFACTURING PLAN

PROCEDURE

EP-140

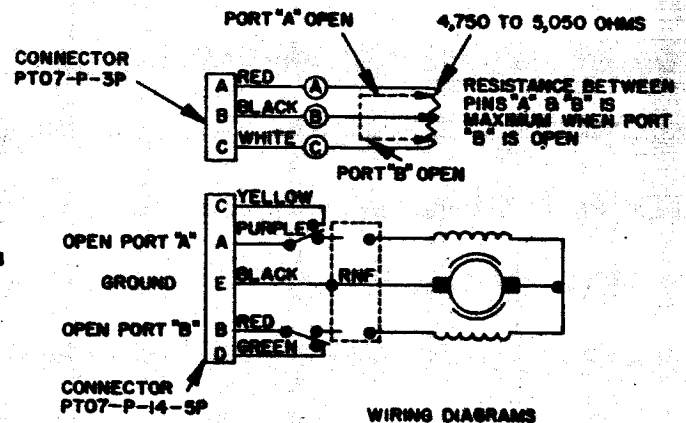
PAGE

3 of 4



NOTES:

1. SEE PAGE 4 FOR THE 10417100 4.00-INCH IRIS MIXING VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE MIXING VALVE ARE 12.90 BY 8.52 BY 6.70 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 8.20 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.



REVISION DATE

MSFC - Form 1151-2 (June 1961)

10417100-753

10417100

1.4 Shock Withstanding Capability. The mixing valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 20 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.5 Vibration Withstanding Capability. The mixing valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 10 minutes duration in each of the three major axes under the following conditions:

- 20 to 45 c.p.s. at one g,
- 45 to 95 c.p.s. at 0.01-inch double amplitude displacement, and
- 95 to 2,000 c.p.s. at 5 g's.

2. TEST AND DELIVERY REQUIREMENTS

The destructive and nondestructive acceptance test and the preparation for delivery of the mixing valve are outlined in Qualification Test Specification 10481643 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-7272
MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33586
Army Ballistic Missile Agency -
ABMA-STD-29

3.3 Drawings:

Ordnance Corps - 10419909
10481643
10509300
10509302
10509305
10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	Not Applicable
SA-1	"A" Rev. (Applies to the nonflight precooling package only)
SA-2	"A" Rev. (Applies to the nonflight precooling package only)
SA-3	"A" Rev. (Applies to the nonflight precooling package only)
SA-4	"A" Rev. (Applies to the nonflight precooling package only)
SPARES	Before installing modify to latest configuration

10417100

REVISION DATE

MSFC - Form 1181-1 (June 1961)

DATA SHEET	
Nomenclature: Mixing Valve (Iris)	
Drawing Numbers: 10481703	Vendor: Lundy Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 8,741 $\times 10^{-6}$ /cy.	MCBF (in cycles): 114.4
Number of Components this Data Represents: 17	Total Cycles of Operation: 572
Number of Failures Reported: 5	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>2 g at 20 - 50 cps, 10 g at 110 - 2000 cps.</u> <u>0.016 in. D.A. at 50 - 110 cps</u>	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out	<u>1</u>	Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
<u>1</u>	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>2</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report IN-P&VE-E-62-5, January 21, 1962			

Additional information concerning the 10481703 valve:

All five failures were reported on Inspection Reports.

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10481703 4.00-INCH IRIS MIXING VALVE				2 June 1962	EP-140
				APPROVED	PAGE
				1	OF 4

1. DESCRIPTION.

The 4.00-inch iris mixing valve is a motor operated modulating valve. The mixing valve is a component of the preflight instrument containers cooling system. A mixing valve is used in instrument containers 13, 14, 15, and 16 to vary the air flow within the container from full cooling to full by-pass or to an intermediate position, as required to maintain a stable temperature. The mixing valve is installed in instrument containers 13, 14, 15, and 16 as shown in the installation view. The various functional characteristics of the mixing valve are as follows:

- 1.1 Mechanical Performance Characteristics. The mixing valve is capable of performing mechanically as follows:
 - a. Operating media: Air or gaseous nitrogen.
 - b. Nominal operating pressure: 18 inches of H₂O.
 - c. Proof pressure: 36 inches of H₂O.
 - d. Burst pressure (without bursting): 72 inches of H₂O. (CAUTION: Use only for destructive acceptance testing.)
 - e. Operating temperature range: -65° to +125° F.
 - f. Storage temperature: -80° to +160° F.
 - g. Flow rate: 24 lb./min. of air at 15 inches of H₂O through each opening.
 - h. Actuation time: The mixing valve is capable of full traverse, in either direction (open to by-pass or by-pass to open) in 11 ± 2 seconds. Time measured from signal on to signal off.
 - i. Distance from edge of iris blades to center post rubber washer: $.04 \pm .01$ dimension must be met, as shown in detail "A" on page 2.
 - j. External leakage (outlet ports capped): 4.5 s.c.f.m. maximum when pressurized through the inlet port with air or GN₂ to 27 inches of H₂O.
- 1.2 Electrical Performance Characteristics. The mixing valve is capable of performing electrically as follows:
 - a. Operating voltage range: 18 to 30 v.d.c.
 - b. Maximum operating current of actuator: 2 a. at 27 v.d.c.
 - c. Insulation resistance: 50 megohms minimum at 500 v.d.c. between each pin and the valve housing.
 - d. Potentiometer resistance: Port "A" open - 0 to 200 ohms between pins "A" and "B", 4,750 to 5,050 ohms between pins "B" and "C". Port "B" open - 4,750 to 5,050 ohms between pins "A" and "B", 0 to 200 ohms between pins "B" and "C".
 - e. Potentiometer resolution: 1/2 percent minimum.
 - f. Potentiometer overshoot: 2 percent (100 ohms) maximum allowable.
 - g. The wiring diagrams are shown on page 3.
- 1.3 Life Cycle. The mixing valve is capable of completing 5,000 cycles minimum with an internal temperature of -65° F. without damage or impairment of performance.

(Continued on page 4)

REVISION DATE	10481703
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MSFC - Form 1181 (June 1961)

MSFC

MANUFACTURING ENGINEERING DIVISION

NASA

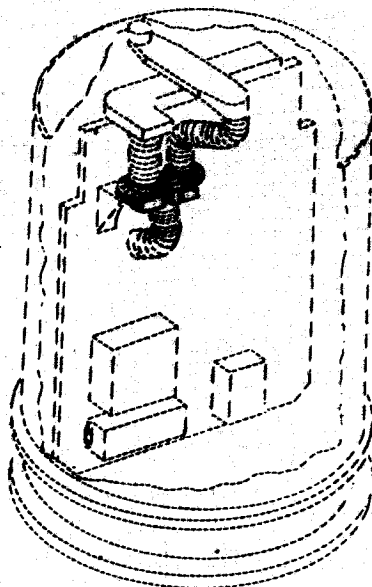
PAGE

2 of 4

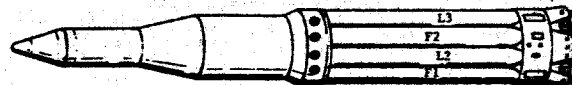
PROCEDURE

EP-140

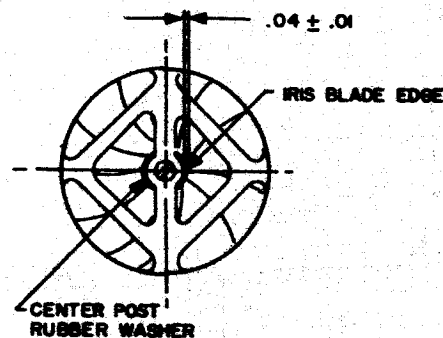
MANUFACTURING PLAN



INSTALLATION VIEW - TYPICAL ON INSTRUMENT
CONTAINERS 13, 14, 15, & 16



GENERAL LOCATION



DETAIL A - MIXING BLADES ADJUSTMENT
(TYPICAL FOR BOTH PORTS "A" & "B")

NOTES

- (A) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (B) STAMP THE CURIE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (C) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (D) OR APPROVED EQUIVALENT.
- (E) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (F) LUBRICATE O-RINGS WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE 2 OR APPROVED EQUIVALENT.

LEGEND

10481703 4.00-INCH IRIS MIXING VALVE
("A" REV.) (LUNDY MANUFACTURING CORP.,
LCA-M-44F-3) A B C D E F

DRAWN BY:	B. Dennis	ENGINEERING DRAWING RELEASE A	REVISION TO:	10481703	REVISION DATE OF THIS PAGE
PLANNER:	W. E. Bunnell		SO'S		
WRITER:	W. W. Franklin				
APPROVED BY:	W. W. Franklin		ART CONTROL NO.	M-ME-EP140-754	

MSFC - Form 1151-1 (June 1961)

MANUFACTURING PLAN

PROCEDURE

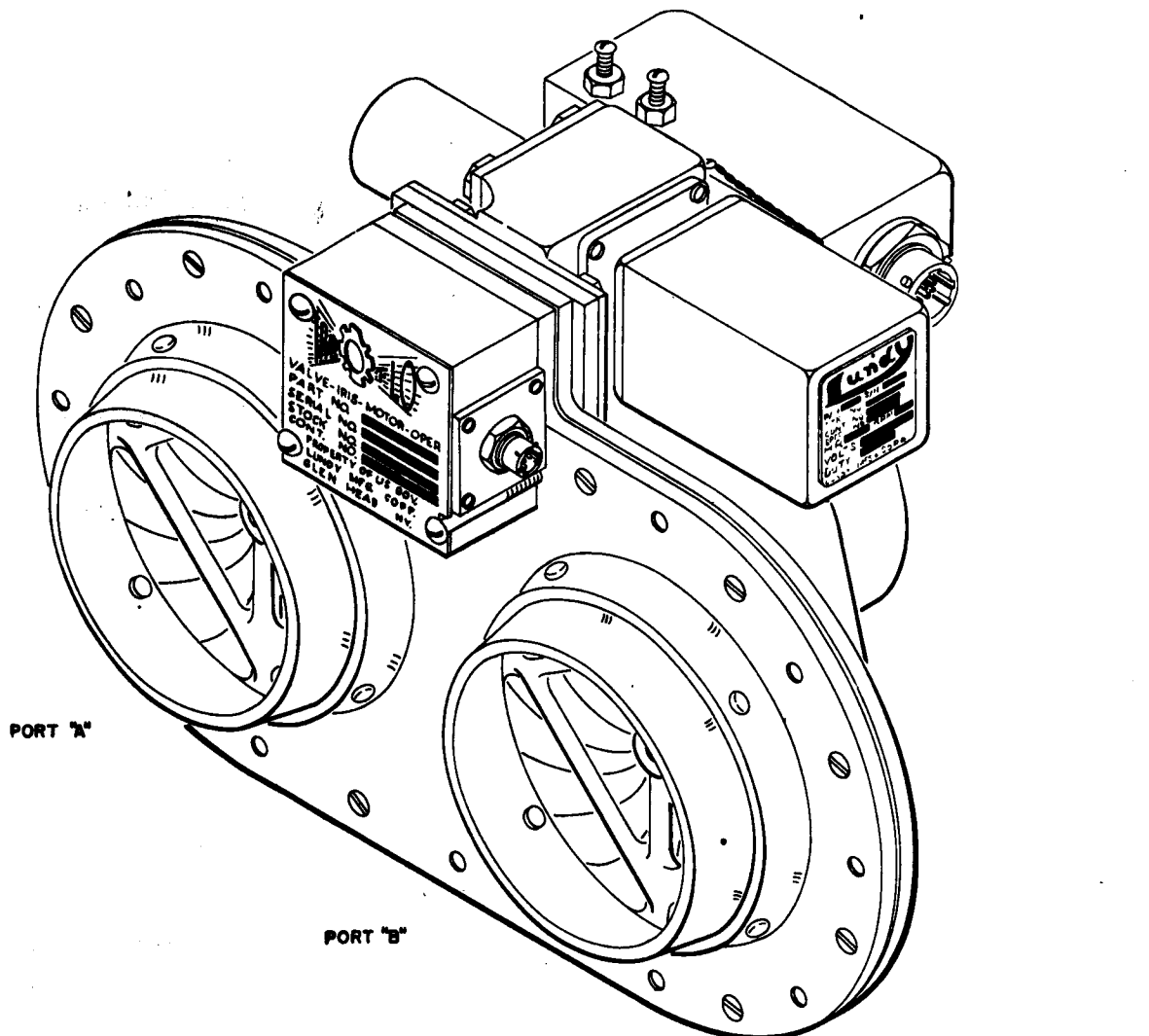
EP-140

PAGE

3

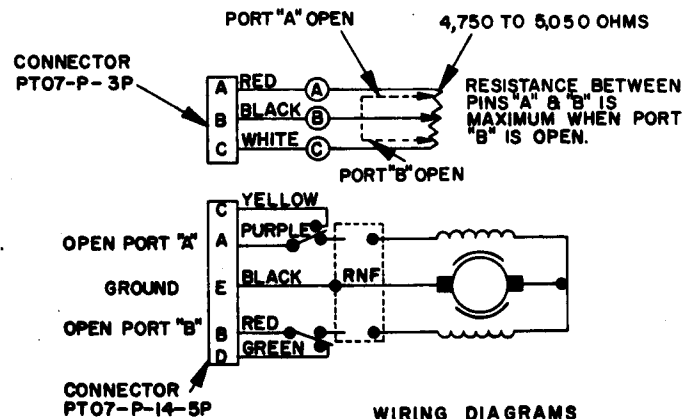
OF

4



NOTES:

1. SEE PAGE 4 FOR THE 10481703 4.00-INCH IRIS MIXING VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE MIXING VALVE ARE 12.90 BY 8.52 BY 6.70 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 8.20 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.



WIRING DIAGRAMS

REVISION DATE

MSFC - Form 1151-2 (June 1961)

M-MS-EP140-754

10481703

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are preformed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The mixing valve is designed to withstand, without damage or impairment of performance, six shocks on one of the following durations and wave forms at 20 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The mixing valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 10 minutes duration in each of the three major axes under the following conditions:

20 to 45 c.p.s. at one g,
45 to 95 c.p.s. at 0.01-inch double amplitude displacement, and
95 to 2,000 c.p.s. at 5 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance test and the preparation for delivery of the mixing valve are outlined in Qualification Test Specification 10481643 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33586

Army Ballistics Missile Agency -
ARMA-STD-29

3.3 Drawings:

Ordnance Corps - 10419909
10481643
10509300
10509302
10509305
10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"A" Rev.
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev.
SPARES	Before installing modify to latest configuration

10481703

MSFC - Form 1151-1 (June 1968)

REVISION DATA

SUMMARY SHEET

Nomenclature Valve, Fill and Vent

Drawing Numbers: 10414030,
20M30131

Vendor: Marotta Valve Corp.

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 2,000 cy.

Failure Rate: $6,993 \times 10^{-6}/\text{cy.}$

MCBF (in cycles): 143

Total Number of Components
this Data Represents: 29

Total Cycles of Operation:
1,287

Total Number of
Failures Reported: 9

Vehicle Equipment: X
Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
<u>8</u>	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-9 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valve, Fill and Vent	
Drawing Numbers: 10414030	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 24,390 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 14 Number of Failures Reported: 7	MCBF (in cycles): 41 Total Cycles of Operation: 287 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>5 g at 20 - 55 cps, 20 g at 140 - 2000 cps,</u> <u>0.03 in. D.A. at 55 - 140 cps</u>	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>6</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report IN-P&VE-E-62-5, January 21, 1962			

Additional information concerning the Fill and Vent Valve No.
10414030

All seven failures were reported on Inspection Reports.

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MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE				15 March 1962	EP-140
SATURN COMPONENTS ASSEMBLY PROCEDURE 10414030 BOTTLE FILL AND VENT VALVE				APPROVED <i>R. Paul</i>	PAGE 1 of 4

1. DESCRIPTION.

The bottle fill and vent valve 10414030 is a normally closed solenoid operated vent valve that incorporates system, ~~fill~~, gage, and vent ports. The vent valve is a component of the control pressure system. The valve is used to fill and vent the control pressure system high pressure storage spheres with GN₂ and is designed to operate by electrical solenoid action. The valve is installed on the high pressure storage sphere assembly 10413938 in the aft end of container F2 as shown in the installation view. The various functional characteristics of the valve are as follows:

1.1 Mechanical Performance Characteristics. The valve is capable of performing mechanically as follows:

- a. Operating media: Air, gaseous nitrogen, or helium.
- b. Nominal operating pressure: 3,000 p.s.i.g. internal pneumatic pressure.
- c. Proof pressure: 4,500 p.s.i.g. internal pneumatic pressure.
- d. Burst pressure (without bursting): 7,500 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Operating temperature range: -65° to +165° F.
- f. Leakage past main seat: 5 s.c.i.m. maximum with an internal pneumatic pressure of 3,000 p.s.i.g. applied through the fill port throughout the operating temperature range.

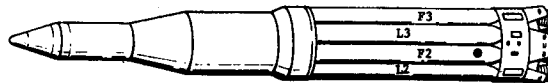
1.2 Electrical Performance Characteristics. The valve is capable of performing electrically as follows:

- a. Solenoid coil resistance: 17 to 19 ohms at 68° F.
- b. Operating current for continuous solenoid: 1.3 a. maximum at 24 v.d.c.
- c. Insulation resistance: 50 megohms minimum between each isolated terminal and valve body with application of 500 v.d.c. to terminals.
- d. Solenoid operating voltage with 3000 p.s.i.g. applied to the valve: Actuation - 18 v.d.c. Deactuation - 10 v.d.c. maximum to one v.d.c. minimum.

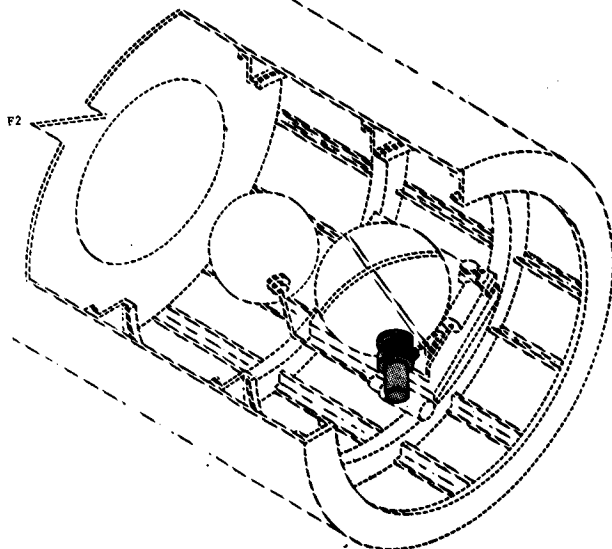
CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

REVISION DATE

10414030



GENERAL LOCATION



INSTALLATION VIEW - LOOKING FORWARD

LEGEND

10414030

BOTTLE FILL AND VENT VALVE ("B" REV.)
 (MAROTTA VALVE CORP. 213834)

- | | | | |
|-----|-----------------|---------------------------------------|---|
| 1. | 135042 | RETAINER SCREW | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 2. | 111112-EB1 | SET SCREW LOCKING SLUG (3 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 3. | 135052 | CAGE | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 4. | 135061 | CAGE SCREEN | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 5. | 121902-19 | SEIM WASHER (AS REQUIRED) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 6. | 113601 | POPPET RETURN SPRING | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 7. | 108241-10 | BACKUP WASHER | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 8. | J200A10 | POPPET PREFORMED PACKING (O-RING) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 9. | 139262-1 | VALVE POPPET | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 10. | 129861-1 | POPPET SEAT | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 11. | 129872-1 | SEAT SUPPORT | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 12. | J200A14 | SEAT PREFORMED PACKING (O-RING) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 13. | 135034 | VALVE BODY | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 14. | 135872-1321 | RECEPTACLE INSULATOR | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 15. | J200B113 | RECEPTACLE PREFORMED PACKING (O-RING) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 16. | MS3102E-10SL-AP | RECEPTACLE (BENDIX #10-69211) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 17. | AN936A4 | RECEPTACLE WASHER (4 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 18. | AN5150A-5 | RECEPTACLE SCREW (4 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 19. | MS20995C-20 | LOCKWIRE | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 20. | J200A30 | ADAPTER PREFORMED PACKING (O-RING) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 21. | J200A18 | BODY PREFORMED PACKING (O-RING) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 22. | J200A17 | BODY PREFORMED PACKING (O-RING) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 23. | J24A1 | SOCKET HEAD MACHINE SCREW (2 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 24. | MS35337-79 | LOCK WASHER (2 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 25. | 135073 | BODY ADAPTER | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 26. | MS35337-79 | LOCK WASHER (3 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 27. | J24A1 | SOCKET HEAD MACHINE SCREW (3 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 28. | J200A30 | COVER PREFORMED PACKING (O-RING) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 29. | 213312-1311 | COIL AND CORE ASSEMBLY | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 30. | 203031-1 | ARMATURE AND GUIDE ASSEMBLY | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 31. | 107261 | LOCK NUT | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 32. | 107331 | FLAT WASHER | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 33. | 107281 | LOCKWIRE SCREW | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 34. | 107281 | ARMATURE LOCK NUT | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 35. | 102961 | COVER SCREW (2 PLACES) | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |
| 36. | 135172-1 | COIL COVER | (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) |

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509303.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) OR APPROVED EQUIVALENT.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) TORQUE 500 TO 700 INCH-POUNDS.
- (G) LUBRICATE WITH DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.
- (H) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (I) TORQUE 4 TO 6 INCH-POUNDS.
- (J) TORQUE 8 TO 10 INCH-POUNDS.

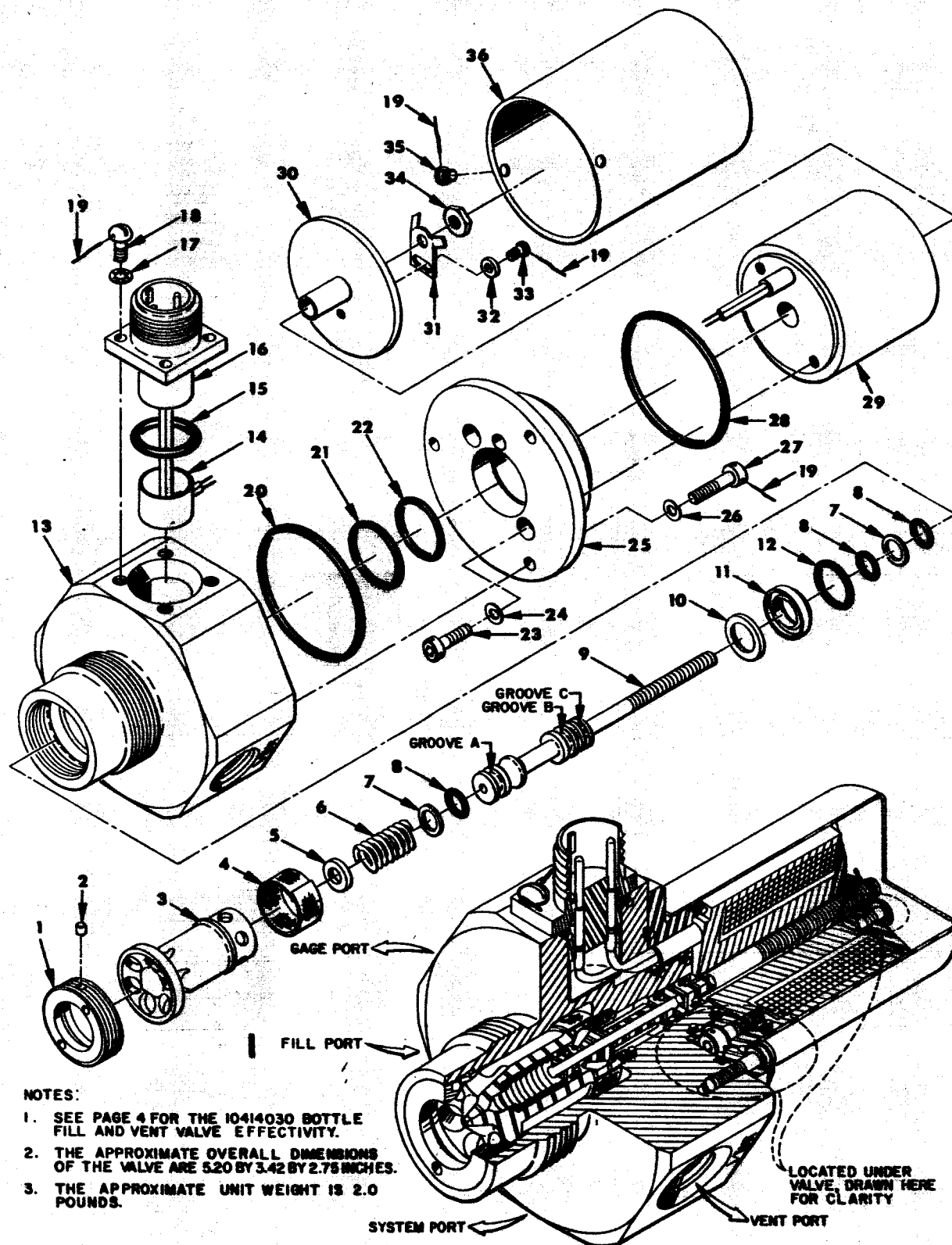
DRAWN BY:	R. A. Fortner	ENGINEERING DRAWING RELEASE	REVISION TO:	10414030	REVISION DATE OF THIS PAGE
PLANNER:	Wm. E. Bennett	B	BO'S		27 Apr 1962
WRITER:	L. J. Allen		ART CONTROL NO.	M-MS-EP140- 683-A	
APPROVED BY:	N. Wright				

MSFC - Form 1151-1 (June 1961)

MANUFACTURING PLAN

PROCEDURE EP-140

PAGE 3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 10414030 BOTTLE FILL AND VENT VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ARE 5.20 BY 3.42 BY 2.75 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 2.0 POUNDS.

REVISION DATE

27 APR 1962

MSFC - Form 1151-2 (June 1961)

MS-ME 1040-683-A 10414030

1.3 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
 8-milliseconds duration - sine wave, or
 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 3 g's.
 55 to 100 c.p.s. at 0.02-inch double amplitude displacement.
 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The qualification and acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10419911 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specification.
 Military - MIL-E-5272

3.2 Standards.
 Military - MIL-STD-130
 MS33540
 Army Ballistic Missile Agency
 ABMA-STD-18

3.3 Drawings.
 Ordnance Corps - 10419911
 10509302
 10509303
 10509305
 10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"B" Rev.
SA-1	"B" Rev.
SA-2	"B" Rev.
SA-3	"B" Rev.
SA-4	"B" Rev.
SPARES	Before installing modify to latest configuration

10414030

REVISION DATE

DATA SHEET	
Nomenclature: Valve (Sphere, Fill and Vent)	
Drawing Numbers: 20M30131	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 2,000 x 10 ⁻⁶ /cy.	MCBF (in cycles): 500
Number of Components this Data Represents: 15	Total Cycles of Operation: 1,000
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Reference page 3, II.6.1	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

II.6.1
Page 11 of 18

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
Low			
High			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the Bottle Fill and Vent Valve, Part No. 20M30131:

The two failures were reported on Inspection Reports.

NOTE: Valves 10414030 and 20M30131 are identical, physically and functionally.

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MSFC		MANUFACTURING ENGINEERING DIVISION		NASA
MANUFACTURING PLAN			DATE	PROCEDURE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30131 BOTTLE FILL AND VENT VALVE			15 June 1962	MP1-2000
			APPROVED <i>P. Galt</i>	PAGE 1 of 4

1. DESCRIPTION.

The bottle fill and vent valve 20M30131 is a normally closed, solenoid operated, 2-way, 2-position, control valve that incorporates system, fill, gage, and vent ports. The vent valve is a component of the control pressure system and the camera ejection system. The valve is used to fill and vent the control pressure system and the camera ejection system high pressure GN₂ storage spheres. The valve is controlled by electrical signal that energizes the valve solenoid. The valve used in the control pressure system is located on the high pressure sphere assemblies located in the rear skirt of container F3 as shown in the installation view. The valve used in the camera ejection system is located on the high pressure sphere assembly located on the fin II side of the radial beam between fins I and II on the spider beam just forward of container LC as shown in the installation view. The various functional characteristics of the valve are as follows:

1.1 Mechanical Performance Characteristics. The valve is capable of performing mechanically as follows:

- a. Operating media: Air, gaseous nitrogen, or helium.
- b. Nominal operating pressure: 3,000 p.s.i.g. internal pneumatic pressure.
- c. Proof pressure: 4,500 p.s.i.g. internal pneumatic pressure.
- d. Burst pressure (without bursting): 7,500 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Operating temperature range: -65° to +165° F.
- f. Leakage past main seat: 5 s.c.i.m. maximum with an internal pneumatic pressure of 3,000 \pm 20 p.s.i.g. applied through the fill port throughout the operating temperature range.
- g. External leakage: 2 s.c.i.m. maximum when pressurized to 3,000 \pm 20 p.s.i.g.

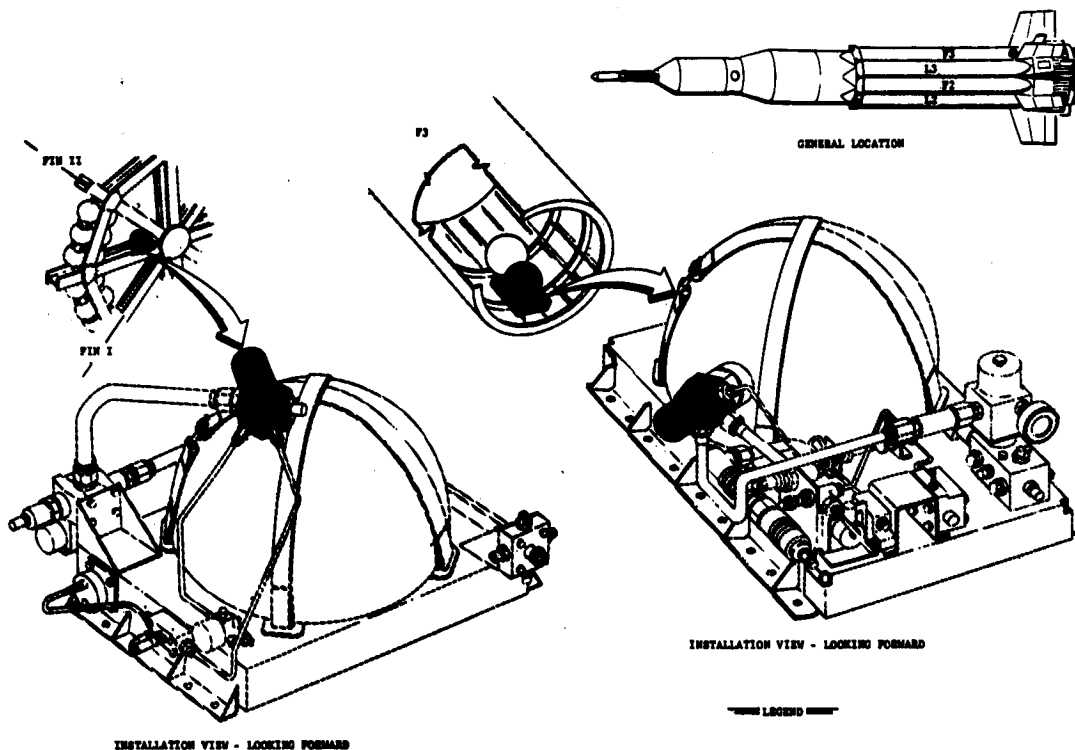
1.2 Electrical Performance Requirements. The electrical performance requirements of the valve are as follows:

- a. Solenoid operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal.
- b. Solenoid coil resistance: 17 to 19 ohms at 68° F.
- c. Solenoid operating current: 1.8 a. maximum at the nominal supply voltage of 28 v.d.c.
- d. Insulation resistance: 50 megohms minimum between each isolated terminal and valve body with application of 500 v.d.c. to terminals.
- e. Solenoid operating voltage with 3,000 p.s.i.g. pneumatic pressure applied to the inlet port of the valve: Actuation - 18 v.d.c. maximum. Deactuation - 10 v.d.c. maximum to one v.d.c. minimum.
- f. Solenoid voltage endurance: 28 \pm 2 v.d.c. applied to the coil continuously for a minimum of 4 hours.

(Continued on page 4)

REVISION DATA

20M30131



- NOTES
- ① CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
 - ② IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - ③ STAMP THE CURB DATE OF THE OLDEST PERFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
 - ④ OR APPROVED EQUIVALENT.
 - ⑤ CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
 - ⑥ TORQUE 500 TO 700 INCH-POUNDS.
 - ⑦ LUBRICATE WITH NON-CORROSIVE CORP. D.C. 55 OR APPROVED EQUIVALENT.
 - ⑧ LOCKWIRE IN ACCORDANCE WITH MS33540.
 - ⑨ TORQUE 4 TO 6 INCH-POUNDS.
 - ⑩ TORQUE 8 TO 10 INCH-POUNDS.

20M30131

1. 135042
2. 111112-001
3. 135032
4. 135061
5. 121902-19
6. 113601
7. 106241-10
8. J200A10
9. 139262-1
10. 129061-1
11. 129072-1
12. J200A14
13. 135034
14. 135072-1321
15. J200B113
16. MS3102B-106L-4P
17. AN336AA
18. AN315C4-5
19. MS30995C-20
20. J200A30
21. J200A18
22. J200A17
23. J20A1
24. MS33337-79
25. 135073
26. MS33337-79
27. J20A1
28. J200A30
29. 213312-1311
30. 203031-1
31. 107261
32. 107231
33. 107291
34. 107281
35. 103961
36. 133172-1

BOTTLE FILL AND VENT VALVE
(BOTTLE VALVE CORP. 213854)

- ① RETAINER SCREW
- ② SET SCREW LOCKING FLUID (3 PLACES)
- ③ CAGE
- ④ CAGE SCREW
- ⑤ RUSH WASHER (AS REQUIRED)
- ⑥ POPPET RETAIN SPRING
- ⑦ BACKUP WASHER
- ⑧ POPPET PREFORMED PACKING (O-RING)
- ⑨ VALVE POPPET
- ⑩ POPPET SEAT
- ⑪ SEAT SUPPORT
- ⑫ SEAT PREFORMED PACKING (O-RING)
- ⑬ VALVE BODY
- ⑭ RECEPTACLE INSULATOR
- ⑮ RECEPTACLE PREFORMED PACKING (O-RING)
- ⑯ RECEPTACLE (BUSHING 910-69211)
- ⑰ RECEPTACLE WASHER (4 PLACES)
- ⑱ RECEPTACLE SCREW (4 PLACES)
- ⑲ LOCKWIRE
- ⑳ ADAPTER PREFORMED PACKING (O-RING)
- ㉑ BODY PREFORMED PACKING (O-RING)
- ㉒ BODY PREFORMED PACKING (O-RING)
- ㉓ SOCKET HEAD MACHINE SCREW (2 PLACES)
- ㉔ LOCK WASHER (2 PLACES)
- ㉕ BODY ADAPTER
- ㉖ LOCK WASHER (3 PLACES)
- ㉗ SOCKET HEAD MACHINE SCREW (3 PLACES)
- ㉘ COVER PREFORMED PACKING (O-RING)
- ㉙ COIL AND CORE ASSEMBLY
- ㉚ ARMATURE AND GUIDE ASSEMBLY
- ㉛ LOCK NUT
- ㉜ FLAT WASHER
- ㉝ LOCKWIRE SCREW
- ㉞ ARMATURE LOCK NUT
- ㉟ COVER SCREW (2 PLACES)
- ㊱ COIL COVER

DRAWN BY:

PLANNER:

WRITER:

APPROVED BY:

ENGINEERING
DRAWING
RELEASE

REVISION TO:

20M30131

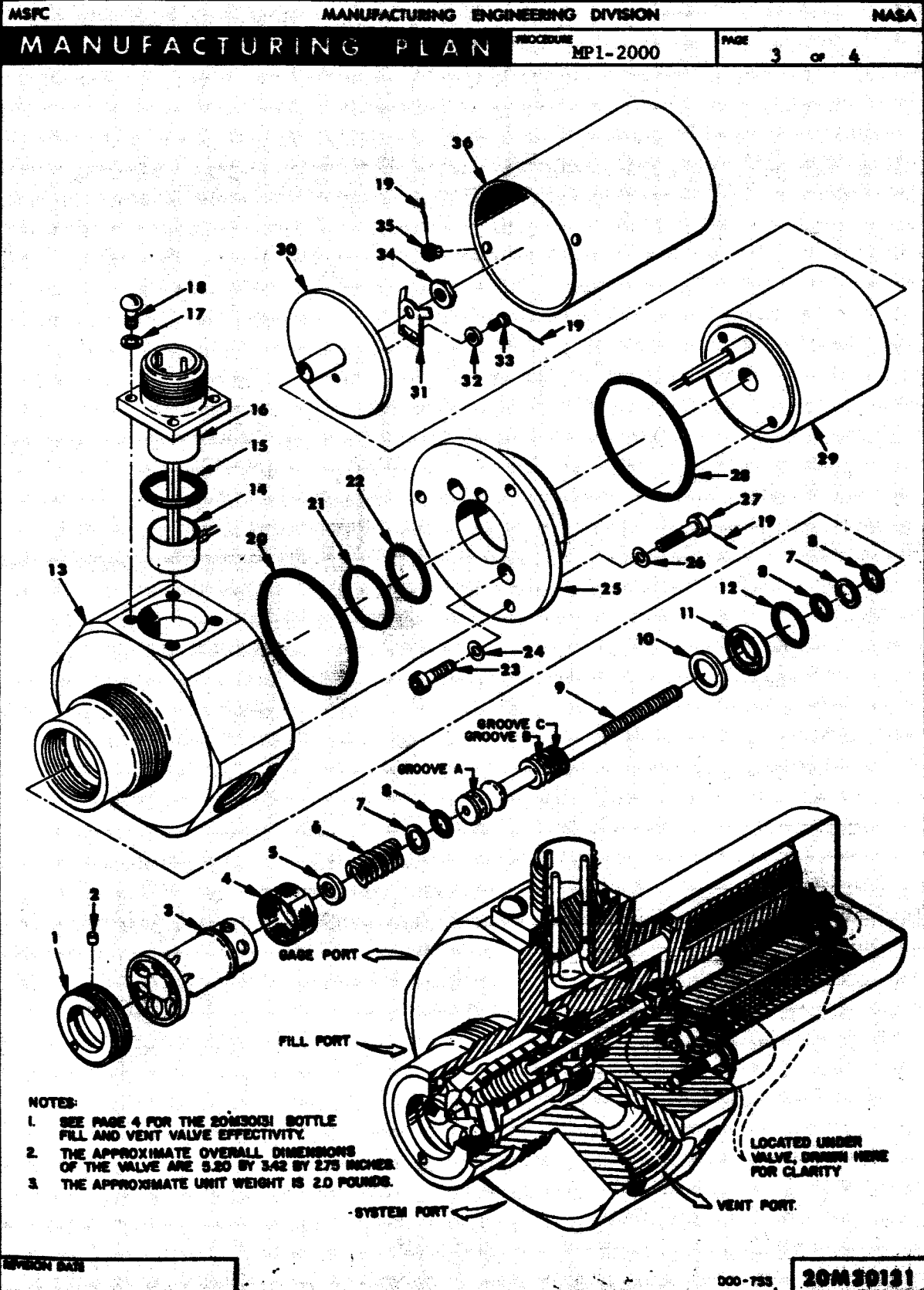
EO's

ART CONTROL NO.

M-ME-MP1-2000-755-A

REVISION
DATE OF
THIS PAGE

20 Jul 1962



1.3 Life Cycle. The valve is capable of 2,000 actuating and deactuating operations of the solenoid with the fill port pressurized to 3,000 \pm 20 p.s.i.g. pneumatic pressure.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes with the inlet port pressurized to 3,000 \pm 20 p.s.i.g. pneumatic pressure:

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 8 g's,
55 to 95 c.p.s. at 0.03-inch double amplitude displacement, and
95 to 2,000 c.p.s. at 15 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The qualification and acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10M01149 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 MIL-Q-9858
NASA - MSFC-SPEC-164

3.2 Standards:

Military - MIL-STD-130
 MS33540
Army Ballistic Missile
Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302 10509311
 10509303 10M01149

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	
SA-6	
SA-7	
SA-8	
SA-9	
SA-10	
Spares	Before installing modify to latest configuration

20M30131

MSFC - Form 1182-1 (June 1961)

REVISION DATE **20 JUL 1962**

SUMMARY SHEET	
Nomenclature Pre-Valve (LOX)	
Drawing Numbers: 10414005, 20M30042, 60C27830 Saturn I Vehicle	Vendor: North American Aviation Parker Aircraft Co. Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $4,494 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 130 Total Number of Failures Reported: 101	MCBF (in cycles): 222.5 Total Cycles of Operation: 22,481 Vehicle Equipment: X Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out	<u>4</u>	Indicator Shows:
	Erratic	<u>5</u>	No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
<u>4</u>	Inoperative		Broken/Ruptured:
<u>62</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
<u>1</u>	Operation Sluggish	<u>6</u>	Other: _____
<u>9</u>	Out of Specs		Reference individual drawing sheets
	Oil/Moisture Saturation		
<u>7</u>	Sticking		
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-10 (less flight data)			

DATA SHEET	
Nomenclature: Pre-valve (LOX)	
Drawing Numbers: 10414005	Vendor: North American Aviation
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $2,915 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 49 Number of Failures Reported: 21	MCBF (in cycles): 343 Total Cycles of Operation: 7,203* Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>140°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: <u>Main seal 25 scim, shaft seal 20 scim at 150 psig</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibrations: <u>0.03 in. D.A. at 55 - 110 cps, 5 g at 20 - 55 cps, 20 g at 110 - 2000 cps</u>	

December 1965 (Revised 1965)
 * Minimum total: Serial R-148-V, not shown on cycle logs.

II.7.1
 Page 3 of 25

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic	<u>4</u>	No Open
	Foreign Material	<u>3</u>	No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
<u>1</u>	Operation Sluggish		Other: _____
<u>3</u>	Out of Specs	<u>1</u>	<u>Thermostat improper</u>
	Oil/Moisture Saturation		<u>operation</u>
<u>7</u>	Sticking	<u>1</u>	<u>Blanket heater open</u>
	Would Not Open		<u>circuit</u>
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report IN-P&VE-E-62-5 January 21, 1962			

Additional information concerning the 10414005 valve unit:

Four failures were reported on Unsatisfactory Condition Reports and seventeen on Inspection Reports.

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MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414005 LOX PRELIMINARY VALVE ASSEMBLY		25 August 1961
		PROCEDURE NO. EP-140
		APPROVED <i>R. G. [Signature]</i>
		PAGE 1 OF 4

1. DESCRIPTION.

The LOX preliminary valve assembly 10414005 is a normally closed pneuma-mechanically operated gate type valve. The valve assembly is opened when the solenoid in the fuel and LOX MV-74V control valve 10414027 is energized to allow GN₂ from the control pressure system to pressurize the control port of the valve assembly. The valve is closed only in case of an emergency such as suction line failure or engine malfunction. A valve assembly is used in each of the eight LOX suction lines. Two LOX suction lines are located in the rear skirt of each 70-inch LOX container. The two valve assemblies in the rear skirt of container L1 are installed in the LOX suction lines of engines No. 4 and No. 5. The two valve assemblies in the rear skirt of container L2 are installed in the LOX suction lines of engines No. 1 and No. 6. The two valve assemblies in the rear skirt of container L3 are installed in the LOX suction lines of engines No. 2 and No. 7. The two remaining valve assemblies in the rear skirt of container L4 are installed in the LOX suction lines of engines No. 3 and No. 8. The location of the valve assemblies are shown in the installation view. The various functional characteristics of the valve assembly are as follows:

1.1 Mechanical Performance Characteristics. The valve assembly is capable of performing mechanically as follows:

- a. Line pressure: 25 p.s.i.g. minimum to 150 p.s.i.g. maximum.
- b. Gate play: 1° maximum.
- c. Parallelism between the surface of the closed gate and the flat machined surface of valve housing: $\pm 0^\circ 30'$
- d. Service: LOX
- e. Internal leakage with 75 p.s.i.g. pressure in the line and the gate in both the open and closed positions alternately:
 Shaft seals - 20 s.c.i.m. maximum.
 Gate pin seals - 2 s.c.i.m. maximum.
 Main seat - 25 s.c.i.m. maximum (applies only with gate in the closed position).
- f. External leakage: No leakage allowed.

1.2 Pneumatic Operating Characteristics. The valve assembly is capable of operating pneumatically as follows:

- a. Control cylinder operating temperature range: +70° to +140° F.
- b. Minimum operating pressure: 500 p.s.i.g. internal pneumatic pressure.
- c. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- d. Proof operating pressure: 1,125 p.s.i.g. internal pneumatic pressure.
- e. Burst pressure (without bursting): 1,875 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- f. Operating media: Air, gaseous nitrogen, or helium.
- g. Leakage past the control cylinder: 5 s.c.i.m. maximum with 750 p.s.i.g. internal pneumatic pressure applied.

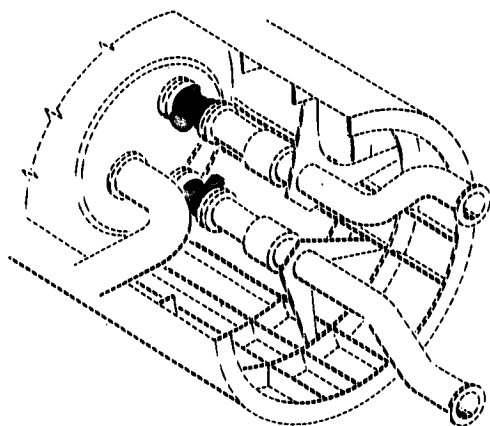
1.3 Electrical Performance Requirements. The electrical performance requirements of the valve assembly are as follows:

- a. Switch actuation: At $1^\circ \pm 0^\circ 30'$ before the gate is in its completely open or closed position.

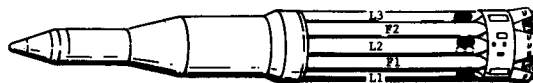
(Continued on page 4)

10414005

MANUFACTURING PLAN



INSTALLATION VIEW - LOOKING FORWARD
(TYPICAL ON CONTAINERS L1, L2, L3, AND L4)



GENERAL LOCATION

LEGEND

LOX PRELIMINARY VALVE ASSEMBLY ("C")
REV. AND EO-6A, -7A, -8, AND -9)
(NORTH AMERICAN AVIATION INC.
NO. 9512-48410-61) A B C D

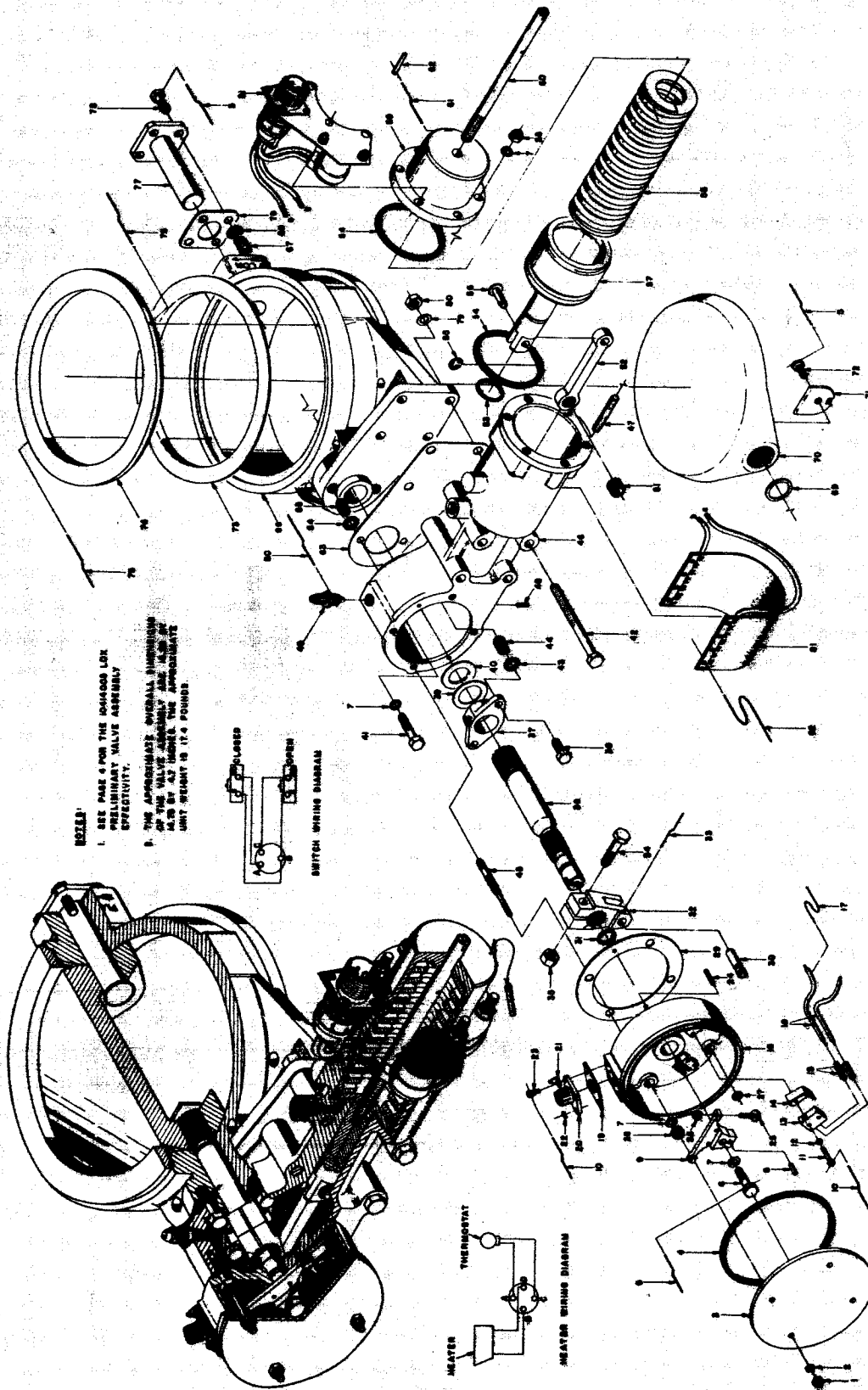
- | | | |
|-----|-----------------|--|
| 1. | NA8679A08W | NUT (4 PLACES) C |
| 2. | 800-015-8 | LOCK-O-SEAL (4 PLACES) F |
| 3. | 9512-48065 | COVER |
| 4. | AM6230B22 | PREFORMED PACKING (O-RING) F H |
| 5. | MS20995M40 | LOCKWIRE J |
| 6. | AM4110A | BOLT |
| 7. | 2W18-416 | WASHER |
| 8. | 9512-48425 | VALVE SWITCH ARM ASSEMBLY |
| 9. | 2P9-7-7 | PIN |
| 10. | 9512-48425-3 | ARM |
| 11. | AN995N20 | SWITCH ASSEMBLY |
| 12. | AN500A2-10 | LOCKWIRE J |
| 13. | 2W1C6-8-16 | SCREW (4 PLACES) L |
| 14. | 2886 | WASHER (4 PLACES) |
| 15. | JE-1 | MICRO SWITCH (MICRO SWITCH CORP.) (2 PLACES) F |
| 16. | | ACTUATOR (MICRO SWITCH CORP.) (2 PLACES) F |
| 17. | | INSULATION TUBING |
| 18. | 9615-48066 | ELECTRICAL WIRING |
| 19. | 10-40450-10 | TYING CORD M |
| 20. | AN5102E10SL3P | BOX |
| 21. | RD191-4002-0001 | GASKET (BENDIX AVIATION CORP.) F |
| 22. | 2W18-4 | CONNECTOR (BENDIX AVIATION CORP.) F |
| 23. | AM500A4-6 | LUG (REPLACES PART NO. R2-1-1) F |
| 24. | AM122676 | WASHER (3 PLACES) |
| 25. | 9612-48422 | SCREW (4 PLACES) N |
| 26. | AM340-6 | PIN |
| 27. | 2W1A117-20-62 | SETScrew (2 PLACES) |
| 28. | NA8679A4W | NUT (2 PLACES) P |
| 29. | 9615-48030 | WASHER (2 PLACES) Q |
| 30. | 9615-48427 | GASKET R |
| 31. | AM622789 | GASKET |
| 32. | 9512-48426 | PIN H |
| 33. | MS20995N51 | PREFORMED PACKING (O-RING) F H |
| 34. | AM5-12A | LEVER S |
| 35. | NA8679A5 | LOCKWIRE J |
| 36. | 9512-48431 | BOLT |
| 37. | 9615-48024 | NUT T |
| 38. | AM4-5A | SHAFT |
| 39. | 9615-48269 | RETAINER |
| 40. | 9615-48062 | BOLT (2 PLACES) U |
| 41. | AM4-11A | WASHER |
| 42. | AM5-32A | SEAL V W |
| 43. | 9615-48013-51 | BOLT (2 PLACES) X |
| 44. | KR-6-1 | BOLT (4 PLACES) |
| 45. | L1246-1-6 | PISTON HOUSING ASSEMBLY |
| 46. | 9615-48068 | RING (2 PLACES) F |
| 47. | 400496 | INSERT (2 PLACES) F |
| 48. | 10614501 | STUD (4 PLACES) Y |
| 49. | 10614500 | CASTING |
| 50. | MS20995C32 | STUD (6 PLACES) Y |
| 51. | 9615-48266 | PIN |
| 52. | 9512-48432 | NIPPLE Z |
| 53. | AM6227813 | LOCKWIRE J |
| 54. | AM6230B6 | LOCKWIRE J |
| 55. | X5133-31MF | BUSHING H |
| 56. | 9512-48014 | LINK H |
| 57. | 402658 | PREFORMED PACKING (O-RING) F H |
| 58. | 9-3224-11 | PREFORMED PACKING (O-RING) F H |
| 59. | 402656 | RING (MADES KOHINOOR INC.) F |
| 60. | 402657 | PIN H |
| 61. | MS20995N32 | PISTON ASSEMBLY H |
| 62. | 20M30382 | SPRING |
| 63. | 9627-48497 | CYLINDER CAP |
| 64. | 9512-48411 | BOLT AD |
| 65. | RL285B-8 | LOCKWIRE J |
| 66. | RD2068B-6-5L | LOCKWIRE J |
| 67. | 9512-48411 | BUSHING H |
| 68. | R2068B-8 | LINK H |
| 69. | RLR285B-8 | PREFORMED PACKING (O-RING) F H |
| 70. | 9512-48424 | PREFORMED PACKING (O-RING) F H |
| 71. | 9615-48591-3 | RING (MADES KOHINOOR INC.) F |
| 72. | 9615-48074-3 | PIN H |
| 73. | AN3H3A | PISTON ASSEMBLY H |
| 74. | 9615-48107 | SPRING |
| 75. | 9512-48413 | CYLINDER CAP |
| 76. | MS20995N91 | BOLT AD |
| 77. | 9512-48360 | LOCKWIRE J |
| 78. | 9615-48020 | LOCKWIRE J |
| 79. | AM4H5A | BOLT (4 PLACES) |
| 80. | 2W18-516 | WASHER (4 PLACES) |
| 81. | NA8679A5 | NUT (4 PLACES) T |
| 82. | 9512-48430 | HEATER ASSEMBLY |

BRASS WIRE (MIL-QQ-W-321, COMP. A) AF

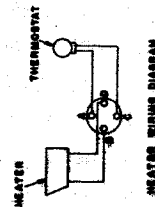
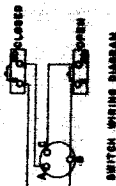
NOTES

- | | | | |
|---|--|----|--|
| A | CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305. | V | PRIOR TO INSTALLING THE VALVE GATE AND SHAFT, PLACE THIS SEAL BLANK IN THE CASTING 9615-48013-9 AND RETAIN WITH THE RETAINER 9615-48024. WITH BOTH HALVES TOGETHER, FORCE THE TOOL 365-798 THROUGH THE SEAL BLANK TO FORM THE SEAL. REMOVE THE TOOL AND SEAL TOGETHER. INSTALL THE SHAFT AND SLIP THE FORMED SEAL FROM THE TOOL TO THE SHAFT BY USING THE RETAINER 9615-48024. |
| B | ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106. | W | LUBRICATE WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE 2 POWDER OR APPROVED EQUIVALENT. BLOW OFF EXCESS LUBRICANT WITH DRY NITROGEN GAS. |
| C | IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130. | X | TORQUE TO 43 INCH-POUNDS. |
| D | STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311. | Y | TORQUE 22 TO 30 INCH-POUNDS. |
| E | CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY. | Z | TORQUE 130 TO 150 INCH-POUNDS. |
| F | OR APPROVED EQUIVALENT. | AA | ADJUST SO THAT WHEN THE PISTON IS IN THE CLOSED POSITION THE GATE IS COMPLETELY CLOSED - TOP SURFACE OF THE GATE PARALLEL WITH THE TOP SURFACE OF THE GATE HOUSING WITHIN PLUS OR MINUS ZERO DEGREES 30 MINUTES. |
| G | TORQUE 16 TO 20 INCH-POUNDS. | AB | TORQUE 50 TO 55 INCH-POUNDS. |
| H | LUBRICATE WITH DOM-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT. | AC | TORQUE 20 TO 25 INCH-POUNDS. |
| J | LOCKWIRE IN ACCORDANCE WITH MS33540. | AD | WIRE RING TO HOUSING TWO PLACES AS REQUIRED. |
| K | TORQUE 50 TO 70 INCH-POUNDS. | AE | TORQUE TO 85 INCH-POUNDS MAXIMUM. |
| L | TORQUE 15 TO 18 INCH-POUNDS. | AF | LACE HEATER ASSEMBLY BLANKET TO PISTON HOUSING ASSEMBLY AS REQUIRED. |
| M | SPOT-TIE THE ELECTRICAL WIRES AT 3-INCH INTERVALS. | | |
| N | TORQUE 6 TO 8 INCH-POUNDS. | | |
| P | TORQUE 10 TO 12 INCH-POUNDS. | | |
| Q | INSTALL UNDER THE NUT PLACED HERE AND ON THE OPPOSITE SIDE OF THE BOX. INSTALL WASHER 2W18-416 UNDER THE TWO REMAINING NUTS. | | |
| R | TORQUE 50 TO 70 INCH-POUNDS. | | |
| S | POSITION THIS LEVER SO THAT THE SPLINE INDEX SCRIBE MARK IS IN LINE WITH THE PUNCH MARK SHOWN ON THE SHAFT. | | |
| T | TORQUE 100 TO 140 INCH-POUNDS. | | |
| U | TORQUE TO 50 INCH-POUNDS. | | |

DRAWN BY:	<i>J. B. Burt</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414005	REVISION DATE OF THIS PAGE
PLANNER:	<i>W. L. B. Burt</i>		EO's: -6A, -7A, -8, and -9	
WRITER:	<i>A. F. Schram</i>		ART CONTROL NO. M-F&AE-EP140-476-A	
APPROVED BY:	<i>W. L. B. Burt</i>	C		8 Dec. 1961



NOTE:
 1. SEE PAGE 4 FOR THE DONALD LOK
 AND VALVE ASSEMBLY
 SPECIFICATIONS.
 2. THE APPROXIMATE OVERALL DIMENSIONS
 OF THE VALVE ASSEMBLY ARE 14 IN.
 HIGH BY 17 IN. WIDE. THE APPROXIMATE
 UNIT WEIGHT IS 17.4 POUNDS.



18414008

MSFC-EP-140

REVISION DATE

1.3 Electrical Performance Requirements (con.)

b. The heater and switch wiring diagrams are shown on page 3.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Acceptance Test Requirements 10414105 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106
Rocketdyne - RA0113-001

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile Agency
ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10414105
10419909
10509302
10509303
10509305
10509311

EFFECTIVITY OF 10414005

VEHICLE	REVISIONS
SA-T	"C" Rev., EO-6A, -7A, -8, and -9
SA-1	"C" Rev., EO-6A, -7A, -8, and -9
SA-2	"C" Rev., EO-6A, -7A, -8, and -9
SA-3	"C" Rev., EO-6A, -7A, -8, and -9
SA-4	"C" Rev., EO-6A, -7A, -8, and -9
Spares	Before installing modify to latest configuration

DATA SHEET	
Nomenclature: Pre-valve (LOX)	
Drawing Numbers: 20M30042	Vendor: Parker Aircraft Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $4,399 \times 10^{-6}/cy.$	MGBF (in cycles): 227.3
Number of Components this Data Represents: 40	Total Cycles of Operation: 9,318*
Number of Failures Reported: 41	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>55 to 93 g</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>4 hours at 165°F</u>	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop): <u>9 triangle waves at 35 g for 10 milliseconds</u>	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>5.0 g at 20 - 55 cps, 2.0 g at 110 - 2000 cps,</u> <u>3.0 g at 20 - 54 cps, 10.0 g at 110 - 2000 cps,</u> <u>102 in. D.A. at 55 - 109 cps, 0.03 in. D.A. at</u> <u>55 - 110 cps (5 minute duration for each)</u>	

December 1965

* Minimum cycles: Serial No. 112, 144,
145, 139 not in cycle logs.

II.7.1
Page 11 of 25

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>33</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>2</u>	Out of Specs	<u>2</u>	<u>Unspecified</u>
	Oil/Moisture Saturation	<u>1</u>	<u>Valve had to be</u>
	Sticking		<u>recycled several</u>
	Would Not Open		<u>times before</u>
	Would Not Close		<u>closed light came</u>
	Pressure:		<u>on</u>
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report F61Q0017, Feb. 1, 1962, Parker Aircraft Co.			

Additional information concerning the LOX Pre-Valve No. 20M30042 component:

Forty-one failures were reported on Inspection Reports.

MSFC	MANUFACTURING ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE	PROCEDURE
TITLE		9 May 1963	MPI-2000
SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30042 LOX BALL ROTOR SHUT-OFF VALVE		APPROVED <i>R. Sack</i>	PAGE 1 OF 4

1. DESCRIPTION.

The LOX ball rotor shut-off valve 20M30042 is a normally closed, spring loaded valve that is opened pneumatically by an integral control piston assembly. The valve is a component of the LOX suction line system and the LOX fill and drain system. One valve is used in each of the eight LOX suction lines and another is used in the LOX fill and drain line. In the LOX suction line system, the shut-off valve is opened when the solenoid in the fuel and LOX MV-74V control valve 20M30128 is energized to allow GN₂ from the control pressure system to pressurize the control port of the integral control piston assembly. The shut-off valve is closed only in case of an emergency such as suction line failure or engine malfunction. In the LOX fill and drain system, the shut-off valve is opened when ground source GN₂ pressurization admitted through the 1/4-inch quick disconnect coupling nipple 20M30390 is allowed to pressurize the control port of the integral control piston assembly. Two shut-off valves are located in the rear skirt of containers L1, L2, L3, and L4 in the LOX suction lines as shown in the installation view. An additional shut-off valve is located in the rear skirt of container L3 in the LOX fill and drain line as shown. The various functional characteristics of the shut-off valve are as follows:

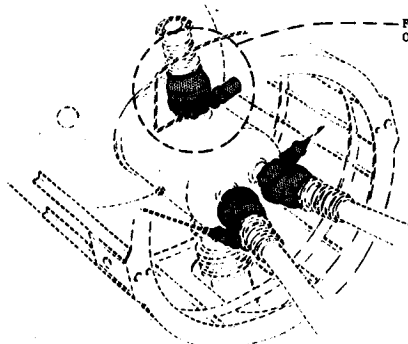
1.1 Mechanical Performance Characteristics. The shut-off valve is capable of performing mechanically as follows:

- a. Flow chamber operating media: LOX or LN₂.
- b. Control piston assembly operating media: Gaseous nitrogen, helium, or air.
- c. Gate opening method: Pneumatic pressurization.
- d. Gate closing methods: Primary - spring force. Alternate A - spring force and pneumatic pressurization. Alternate B - pneumatic pressurization solely. (NOTE: Selection of the operation method is possible by performing only minor modifications when the shut-off valve is installed.)
- e. Flow chamber operating pressure: 150 p.s.i.g. minimum internal pressure.
- f. Control piston assembly operating pressure: 750 p.s.i.g. nominal with 500 p.s.i.g. minimum.
- g. Flow chamber proof operating pressure: 225 p.s.i.g. minimum internal pressure.

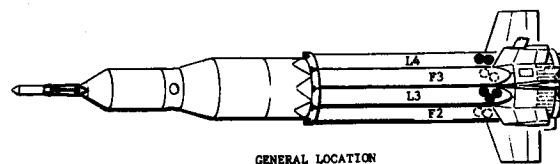
REVISION DATE

20M30042

- h. Control piston assembly proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure.
- i. Flow chamber burst pressure (without rupture): 375 p.s.i.g. minimum internal hydrostatic pressure.
- j. Control piston assembly burst pressure (without rupture): 1,875 p.s.i.g. minimum internal pressure.
- k. Surge pressure withstanding capability: 100 surge pressure cycles from 0 to 300 to 0 p.s.i.g.
- l. Operating temperature range: Liquid nitrogen temperature stabilized in the flow chamber to +165° F.
- m. Temperature shock withstanding capability: 5 shock cycles from +165° F. to LN₂ temperature.
- n. Pressure drop through flow chamber with a LOX flow rate of 3,250 g.p.m. at a density of 71.38 pounds per cubic foot: 1.5 p.s.i. maximum.
- o. Flow chamber gate seal liquid leakage: No liquid leakage, as evidenced by the formation of test medium droplets, with the preliminary valve inlet port pressurized from 0 to 150 p.s.i.g. with either LOX or LN₂.
- p. Flow chamber gate seal gaseous leakage: 5 s.c.i.m. maximum gaseous leakage with the preliminary valve inlet port pressurized from 0 to 150 p.s.i.g. with GN₂.
- q. Flow control gate shaft seal leakage: 5 s.c.i.m. maximum with the flow chamber gate fully open and with the flow chamber pressurized from 0 to 150 p.s.i.g. with LOX, LN₂, or GN₂.
- r. Control piston assembly leakage: 1.0 s.c.i.m. maximum from either the opening or closing portion when they are pressurized from 0 to 750 p.s.i.g. with GN₂.
- s. External flow chamber leakage: None when pressurized from 0 to 150 p.s.i.g. with LOX or GN₂. (NOTE: Flow from bleeds or vents is not considered leakage.)
- t. External control piston assembly leakage: None from either the opening or closing portion when they are pressurized from 0 to 750 p.s.i.g. with GN₂.
- u. Closing response time (measured from the open position switch indication to the closed position switch indication when the control pressure is vented and the gate is moved to the closed position by spring force): 300 ± 100 milliseconds when the flow chamber is pressurized to 100 p.s.i.g. with LOX or LN₂ under static or nominal flow conditions.



INSTALLATION VIEW - LOOKING FORWARD
(TYPICAL ON CONTAINERS L1, L2, L3, AND L4)

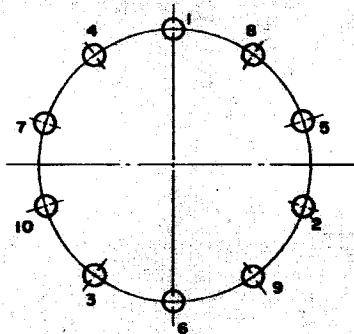


GENERAL LOCATION

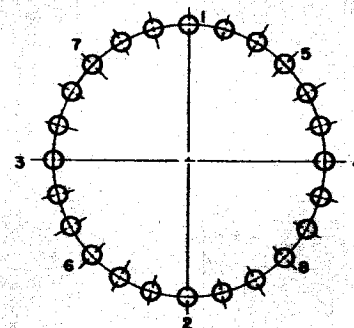
== NOTES ==

- | | | |
|---|---|--|
| <p>(A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164 FOR LOX OR PNEUMATIC SERVICE AS APPLICABLE.</p> <p>(B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.</p> <p>(C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.</p> <p>(D) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN THE CONTROL ASSEMBLY IN ACCORDANCE WITH MSFC-STD-105.</p> <p>(E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.</p> <p>(F) OR APPROVED EQUIVALENT.</p> <p>(G) ANODIZE THE ALUMINUM SURFACES OF THE CONTROL PISTON ASSEMBLY GRAY AND THE FLOW CHAMBER GREEN IN ACCORDANCE WITH MIL-A-8625, TYPE II.</p> <p>(H) LOCKWIRE IN ACCORDANCE WITH MS33540 AND APPLY 3/8-INCH DIAMETER SEAL AFTER TESTING.</p> <p>(J) LUBRICATE THREADS WITH AR-1-F ANTISEIZE COMPOUND OR APPROVED EQUIVALENT.</p> <p>(K) USING THE TORQUE SEQUENCE SHOWN IN DETAIL A, TORQUE IN STEPS TO 50, 90, AND FINALLY 100 INCH-POUNDS. BAKE AT 160° F. FOR 3 HOURS, LET COOL TO ROOM TEMPERATURE, AND RETORQUE THE 8 NUMBERED BOLTS IN THE ORDER SHOWN AND THE 16 REMAINING BOLTS IN CLOCKWISE ORDER TO 100 INCH-POUNDS.</p> <p>(L) FLANGE SURFACES MUST BE PROTECTED FROM SCRATCHES DURING ASSEMBLY.</p> <p>(M) INSTALL IN ACCORDANCE WITH MS33646, CLASS 3B. REMOVE TANG AFTER ANODIZING THE FLANGE.</p> <p>(N) AFTER INSTALLING DO NOT ROTATE BALL PAST THE FULLY CLOSED OR FULLY OPEN POSITION.</p> <p>(P) DO NOT LUBRICATE.</p> <p>(Q) USE BALL ASSEMBLY SHIELD TOOL TO PROTECT THE BALL DURING ASSEMBLY.</p> | <p>(R) BEFORE INSTALLING ITEMS 6.1 THRU 6.8, BURNISH WITH A TEFLON RING OF 6.25 I.D. HAVING APPROXIMATELY 0.015 x 45° CHAMFER ON THE I.D. APPLY A LOAD OF APPROXIMATELY 200 TO 250 POUNDS AND ACTUATE THE BALL FROM OPEN TO CLOSED TO OPEN 100 TIMES. REMOVE THE TEFLON BURNISHING RING AND THE LOOSE TEFLON PARTICLES FROM THE VALVE.</p> <p>(S) INSERT INTO BALL (ITEM 6.11) UNTIL TABS ENGAGE IN SLOTS AND GROOVE. THEN ROTATE UNTIL THE SMALL HOLE MATES WITH THE PROJECTION ON THE LOWER BEARING SUPPORT (ITEM 6.15).</p> <p>(T) FLOW PATH IN TUBE (ITEM 6.12) MUST BE CONCENTRIC WITH BODY (ITEM 6.18.2) OUTLET PORT WITHIN 0.015-INCH. USE THE -3 SPACING RING TO OBTAIN THE INITIAL BALL POSITION. USE ANOTHER DASH NUMBER PART, IF REQUIRED, FOR ALIGNMENT. THE LONGITUDINAL THICKNESS OF THE SPACING RING INCREASES BY 0.0125-INCH WITH EACH INCREASE IN DASH NUMBER.</p> <p>(U) USING THE TORQUING SEQUENCE SHOWN IN DETAIL B, TORQUE IN STEPS TO 50, 90, AND FINALLY 100 INCH-POUNDS. BAKE AT 160° F. FOR 3 HOURS, LET COOL TO ROOM TEMPERATURE, AND RETORQUE IN THE ORDER SHOWN IN DETAIL B TO 100 INCH-POUNDS.</p> <p>(V) INSTALL IN ACCORDANCE WITH MS33646 AND REMOVE TANG.</p> <p>(W) INSTALL IN ACCORDANCE WITH MS33646, CLASS 2B, AND REMOVE TANG.</p> <p>(X) TORQUE 60 TO 85 INCH-POUNDS AND INSTALL THE LOCKING KEY WITH THE TOP SURFACE OF THE STUD SHOULDER 0.010- TO 0.030-INCH BELOW SURFACE OF THE BODY.</p> <p>(Y) LOCKWIRE IN ACCORDANCE WITH MS33540.</p> <p>(Z) SELECT THE SPLINE AND GEAR TOOTH COMBINATION REQUIRED TO ALINE THE FLOW PASSAGE TO WITHIN ± 1° OF THE CENTERLINE OF THE BODY AND FLANGE WITH THE CONTROL ASSEMBLY IN THE OPEN POSITION.</p> | <p>(AA) INSTALL IN ACCORDANCE WITH MS33646, CLASS 2, AND REMOVE TANG.</p> <p>(AB) LUBRICATE BY APPLYING A THIN FILM OF DOW-CORNING CORP. GREASE FS-1281 OR APPROVED EQUIVALENT.</p> <p>(AC) APPLY EVERLUBE CORP. EVERLUBE #811 AND BURNISH TO 0.0002- TO 0.0004-INCH THICKNESS.</p> <p>(AD) AFTER INSTALLING, FLARE THE CYLINDRICAL END TO 0.15-INCH DIAMETER.</p> <p>(AE) BEFORE INSTALLING THE BEARING (ITEM 10.6) AND PREFORMED PACKING (ITEM 10.7), FILL THE GROOVE TO 10% PACK WITH DOW-CORNING CORP. GREASE FS-1281. REMOVE EXCESSIVE LUBRICANT AFTER INSTALLING ITEMS 10.6 AND 10.7.</p> <p>(AF) INSTALL THE -1 PART FOR INITIAL CALIBRATION, THEN DETERMINE BY TESTING THE DASH NUMBER PART REQUIRED. THE -1 PART IS COLOR CODED RED, THE -2 PART GREEN, THE -3 PART BLUE, AND THE -4 PART GOLD. THE ORIFICE DIAMETER IS 0.061 ± 0.002, 0.072 ± 0.002, 0.080 ± 0.002, OR 0.086 ± 0.002 INCH FOR THE -1, -2, -3, OR -4 PART, RESPECTIVELY.</p> <p>(AG) COMPRESS THE SPRINGS WITH SPRING COMPRESSOR TOOL UNTIL THE EDGE OF THE SPRING PLATE (ITEM 10.12) IS WITHIN 0.06-INCH OF BEING FLUSH WITH THE HOUSING.</p> <p>(AH) INSTALL WITH INTERNAL GROOVE IN THE UP POSITION.</p> <p>(AJ) POSITION THE SWITCH SHAFT TO PROVIDE ELECTRICAL CONTINUITY BETWEEN CONNECTOR PINS "A" AND "B" WITH THE VALVE IN THE CLOSED POSITION. ARROW ON SWITCH SHAFT MUST POINT TOWARD THE CONNECTOR.</p> <p>(AK) STAKE TO RETAIN.</p> <p>(AL) INSTALL AFTER TESTING.</p> <p>(AM) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER FLANGE CONTACTS ITS MATING SURFACE.</p> <p>(AN) TORQUE EVENLY AND GRADUALLY TO 100 INCH-POUNDS.</p> <p>(AP) TORQUE 130 TO 180 INCH-POUNDS.</p> |
|---|---|--|

DRAWN BY:	<i>J. Betts</i>	ENGINEERING DRAWING RELEASE B	REVISION TO:	20M30042	REVISION DATE OF THIS PAGE 31 May 1963
PLANNER:	<i>H. Phillips</i>		EO'S	-3	
WRITER:	<i>A. L. Schenk</i>		ART CONTROL NO.	M-ME-E-1185-A	
APPROVED BY:	<i>M. Schlichter</i>				



DETAIL B - 10 HOLE BOLT PATTERN TORQUING SEQUENCE

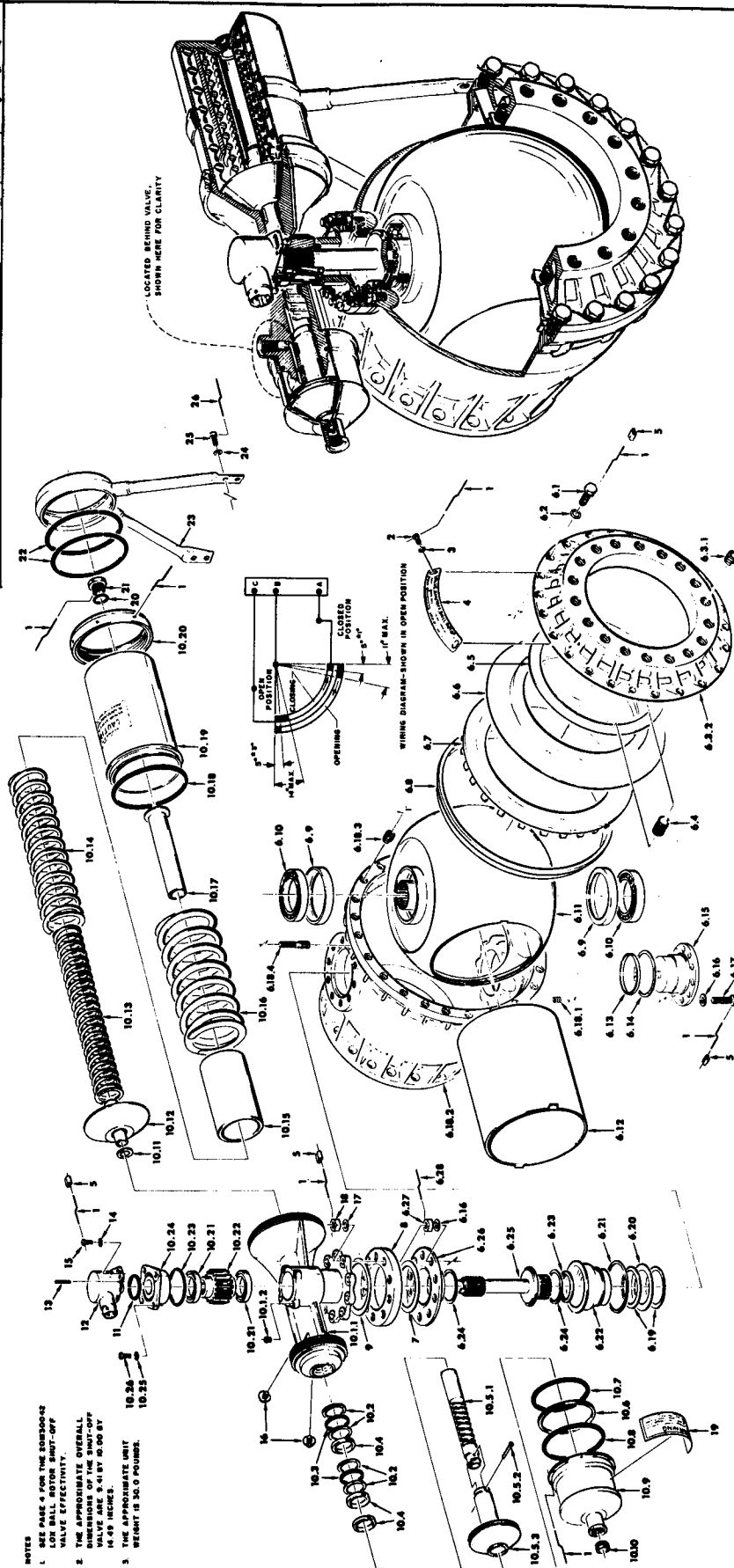


DETAIL A - 24 HOLE BOLT PATTERN TORQUING SEQUENCE

== LEGEND ==

20M30042		LOX BALL ROTOR SHUT-OFF VALVE ("B" REV. & EO-3) (PARKER AIR- CRAFT CO., LOS ANGELES, CALIF., PART NO. F61C0017M1)	
1.	MS20995C32	LOCKWIRE (H)	(A) (B) (C) (D) (E) (F) (G)
2.	AN300AD4-4	SCREW (2 PLACES)	(J)
3.	AN960CAL	WASHER (2 PLACES)	(J)
4.	F61C1527-1	NAMEPLATE	
5.		3/8-INCH DIAMETER ALUMINUM SEAL	
6.	2631603	LOX VALVE ASSEMBLY	
6.1	F61C1541	BOLT (24 PLACES)	(J) (K)
6.2	F61C1690	INLET WASHER (24 PLACES)	(J)
6.3	2631489	FLANGE ASSEMBLY	(L)
6.3.1	MS21208-F6-15	INSERT (18 PLACES)	(M)
6.3.2	2631489-1	FLANGE (MADE FROM UNMACHINED FLANGE F61C1494)	(N)
6.4	F61C1532	SPRING (36 PLACES)	
6.5	F61C2099	STIFFENER	
6.6	F61C1552	SEAL (N)	
6.7	F61C1528	SEAL BACKUP	
6.8	F61C1483	SWEAR RING	
6.9	F61C1557	TEMPERATURE COMPENSATOR	
6.10	F61C1504	2-9/16 O.D. BY 1-13/16 I.D. FULL TYPE BALL BEARING (APPROVED VENDOR, FAPNIR BEARING CO., NEW BRITAIN, CONN., PART NO. AK2983-E8214, "H" REV.)	(P)
6.11	F61C1514	BALL (Q)	
6.12	F61C1526	FLOW TUBE (S)	
6.13	F61C1525-1	SPACING RING (T)	
6.14	F61C1534-1	GASKET (TEFLON)	
6.15	F61C1524	LOWER BEARING SUPPORT (MADE FROM F61C2498)	
6.16	F61C1692	1/4 BOLT WASHER (10 PLACES)	
6.17	MS9061-06	BOLT (10 PLACES)	(2) (U)
6.18	F61C1476-1	BODY ASSEMBLY (V)	
6.18.1	MS21208-F4-10	INSERT (10 PLACES)	(W)
6.18.2	F61C1531-1	BODY (MADE FROM F61C1475)	
6.18.3	MS21208-F5-15	INSERT (24 PLACES)	(X)
6.18.4	F61C1505-1	STUD ASSEMBLY (NEWTON INSERT CO., LOS ANGELES 3, CALIF., PART NO. F-12) (10 PLACES)	(Y)
6.19	F61C1535	BELLEVILLE SPRING	
6.20	F61C1536	SPRING SPACING RING	
6.21	F61C1534-2	GASKET	
6.22	F61C1520	UPPER BEARING SUPPORT	
6.23	2631089	SHAFT SEAL (RACO ENGINEERING, SANTA MONICA, CALIF.)	
6.24	F61C1538	THRUST WASHER	
6.25	F61C1481-1	DRIVE SHAFT (MADE FROM F61C2417)	
6.26	F61C1539	SHAFT RETAINER (MADE FROM F61C2497)	
6.27	F61C1533	NUT (MADE FROM AN315048)	(Z) (AA)
6.28	MS20995C32	LOCKWIRE (V)	
7.	F61C1536	LOWER INSULATOR GASKET	
8.	F61C1540	INSULATOR	
9.	F61C2333	UPPER INSULATOR GASKET	
10.	2631602	CONTROL ASSEMBLY (2)	
10.1	F61C1523	ACTUATOR ASSEMBLY	
10.1.1	F61C1523-1	BODY (MADE FROM F61C1522)	
10.1.2	MS21208-F1-10	INSERT (4 PLACES)	(AB)
10.2	F61C2260	WIPER RING	
10.3	MS29513-129	PREFORMED PACKING (O-RING)	(F) (AB)
10.4	F62C1239	BUSHING	
10.5	2631599	BACK AND PISTON ASSEMBLY	
10.5.1	F61C1479	BACK (AC)	
10.5.2	F61C1545	PISTON LOCK PIN (AD)	
10.5.3	2631607	PISTON (AE)	
10.6	2631606	BEARING	

10.7	F60W1117K230	PREFORMED PACKING (O-RING)	(F) (AB)
10.8	F60W1117F037	PREFORMED PACKING (O-RING)	(F) (AB)
10.9	F61C1521	CYLINDER (AB)	
10.10	F61C1543-1	ORIFICE (J)	(AF)
10.11	F61C1876	SPACER	
10.12	F61C1546	SPRING PLATE	
10.13	F61C1555	INNER SPRING (AG)	
10.14	F61C1549	CENTRAL SPRING (AC)	
10.15	F62C1240	LARGE SPRING SLEEVE	
10.16	F61C1547	OUTER SPRING (AC)	
10.17	F61C1553	INNER SPRING GUIDE	
10.18	F60W1117F043	PREFORMED PACKING (O-RING)	(F) (AB)
10.19	F61C1548	SPRING HOUSING (MADE FROM F61C2429)	
10.20	F61C1550	HOUSING RETAINER RING (J)	
10.21	F61C1712	PISTON GEAR BEARING (FAPNIR BEARING CO., NEW BRITAIN, CONN., PART NO. A541DD-E8360)	(AB)
10.22	F61C1480	PISTON GEAR (AB)	
10.23	F60W1117F029	PREFORMED PACKING (O-RING)	(F) (AB)
10.24	F61C1542	PISTON BEARING SUPPORT	
10.25	F61C1693	WASHER (2 PLACES)	(J)
10.26	AN501AD10-6	SCREW (2 PLACES)	(J)
11.	MS29513-24	PREFORMED PACKING (O-RING)	(F) (AB)
12.	F61C1503	90° TRAVEL ROTARY SWITCH (WATSON SWITCH INC., 2039)	(AC)
13.	MS35672-6	GROOVED PIN (2 PLACES)	(AA)
14.	F61C1693	WASHER (2 PLACES)	(J)
15.	AN501AD10-6	SCREW (2 PLACES)	(J)
16.	F61C1556	VENT SEAL (INTERCHANGEABLE WITH VENT SEAL 20M30028 (EO-1))	(AL) (AM)
17.	F61C1692	1/4 BOLT WASHER (10 PLACES)	
18.	F61C1533	NUT (10 PLACES)	(J) (AN)
19.	F51C1696	GREASE CAUTION TAG	
20.	MS29512-6	PREFORMED PACKING (O-RING)	(F) (AB)
21.	F61C1554	PLUG (J)	(AB)
22.	F62C1534	GASKET (J)	(AB)
23.	F61C1978-2	SUPPORT ASSEMBLY	
24.	AN960C10L	WASHER (4 PLACES)	(J)
25.	AN501AD10-6	SCREW (4 PLACES)	(J)
26.	MS20995C32	LOCKWIRE (V)	



- v. Opening response time (measured from the closed position switch indication to the open position switch indication when control pressure of 500 p.s.i.g. is applied to the control piston assembly): 200 ± 100 milliseconds when the flow chamber is pressurized to 100 p.s.i.g. with LOX or LN_2 under static or nominal flow conditions.
- w. Life cycle performance capability: 1,000 cycles (closed to open to closed) of operation.
- x. Flow chamber relief differential pressure: 50 p.s.i. maximum at a GN_2 relief rate of 18 c.f.m. The GN_2 temperature range is -290° to -270° F.

1.2 Electrical Performance Requirements. The electrical performance requirements of the shut-off valve are as follows:

- a. Position indicating switch circuit resistance: 0.5 ohms maximum between the connector pins when their respective circuits are fully closed.
- b. Position indicating switch insulation resistance: 50 megohms minimum with 500 v.d.c. applied between each electrical connector terminal and the assembly housing or between any two terminals when their respective circuits are fully open.
- c. Position indicating switch closing actuation and deactuation positions: Actuation (possess continuity between electrical connector terminals "A" and "B") - $3^\circ \pm 1^\circ$ before the closing gate reaches its fully closed position. Deactuation (break continuity between electrical connector terminals "A" and "B") - 11° maximum after the opening gate rotates from its fully closed position.
- d. Position indicating switch opening actuation and deactuation positions: Actuation (possess continuity between electrical connector terminals "B" and "C") - $5^\circ \pm 3^\circ$ before the opening gate reaches its fully open position. Deactuation (break continuity between electrical connector terminals "B" and "C") - 14° maximum after the closing gate rotates from its fully open position.
- e. The indication switch wiring diagram is shown on page 2.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The shut-off valve is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 50 g's in each of the three major axes.

1.3 (con.)

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - half sine wave, or
- 5-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The shut-off valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

- 20 to 76 c.p.s. at 2.0 g's,
- 76 to 190 c.p.s. at 0.0067-inch double amplitude displacement,
- 190 to 2,000 c.p.s. at 12.5 g's, and
- 20 to 2,000 c.p.s. at 0.10 g² per c.p.s. random vibration.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the shut-off valve are outlined in Performance Specification 10M01067 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106
 MSFC-SPEC-164
 Military - MIL-E-5272

3.2 Standards:

Military - MIL-STD-130
 MS33540
 NASA - MSFC-STD-105
 Army Ballistic Missile
 Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302
 MSFC - 10419909
 10M01067

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	"B" Rev. and EO-3
SA-6	"B" Rev. and EO-3
SA-7	"B" Rev. and EO-3
SA-8	"B" Rev. and EO-3
SA-9	"B" Rev. and EO-3
SA-10	"B" Rev. and EO-3
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30042

REVISION DATE

DATA SHEET	
Nomenclature: Pre-Valve (LOX)	
Drawing Numbers: 60C27830	Vendor: Parker Aircraft Co.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $6,544 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 41 Number of Failures Reported: 39	MCBF (in cycles): 152.8 Total Cycles of Operation: 5960* Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as Page 11, II.7.1 Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

December 1965

* Minimum operation time. Serial Nos. 149, 152, 158, 159, 225 and 226 do not appear in time/cycle logs.

II.7.1
Page 21 of 25

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>4</u> <u>28</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish	<u>2</u>	Indicator Shows: No Open No Close Mechanical:
<u>4</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>1</u>	Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ <u>Light indicates</u> <u>only partial</u> <u>opening</u>
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 through SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the LOX Ball Rotor Shutoff Valve, Part No. 60C27830

The LOX ball rotor valve is utilized in the LOX fill and drain line and in each of the eight LOX suction lines. It is installed as the LOX fill and drain valve between the LOX tanks and the ground system LOX supply. This normally closed valve is pneumatically actuated with GN_2 through the LOX fill and drain control line to allow filling or draining of the LOX lines. Where the LOX ball rotor valve is used in the suction lines, these valves are designated as LOX prevalues and are pneumatically actuated with GN_2 by the LOX and fuel prevalue control valves. The normally closed LOX prevalues provide a means of shutting off flow in any one or all of the eight suction lines.

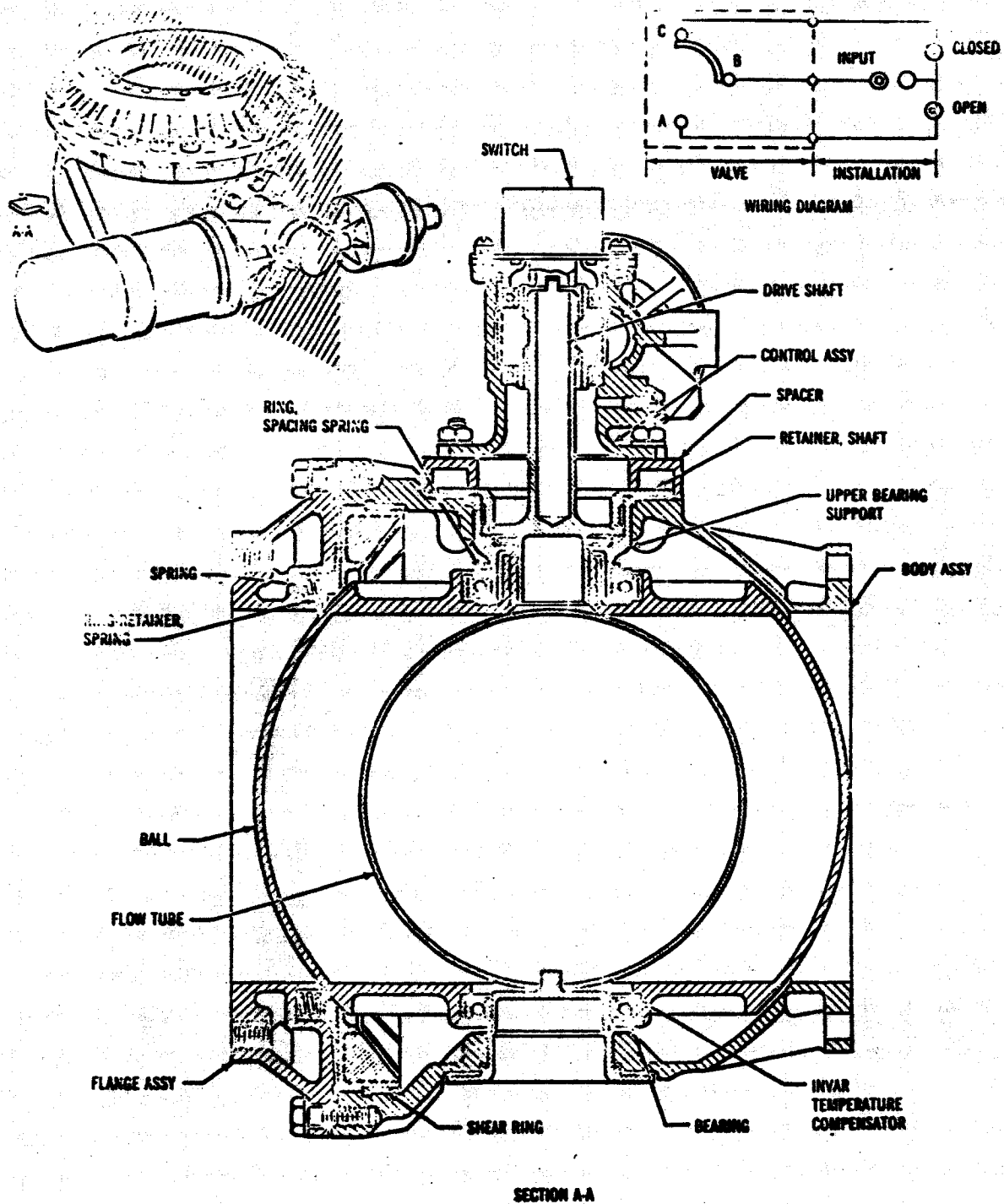
1. Vendor - Parker Aircraft Corp., Part No. F61C0017M1
2. Location -
 - a. Prevalue: Station 192, each LOX suction line
 - b. Fill and drain valve: Station 217, LOX tank No. 3
3. Service -
 - a. Flow chamber: LOX
 - b. Control piston: Helium, air, and GN_2
4. Temperature - Operating: Minus 320°F to plus 165°F
5. Pressure - Flow Chamber:
 - a. Operating: 150 psig
 - b. Proof: 225 psig
 - c. Burst: 375 psig
 - d. Surge: 300 psig in 50 milliseconds, for 100 cycles
6. Pressure - Control piston:
 - a. Operating: Nominal 750 psig, minimum 500 psig
 - b. Proof: 1125 psig
 - c. Burst: 1875 psig
7. Lubrication -
 - a. Flow chamber: Bearings, seals, and sliding surfaces with Molykote Z (Alpha Molykote)
 - b. Control piston assembly: Seals and sliding surfaces with FS-1281 grease (Dow Corning)

WARNING

This grease is toxic. Hands should be washed thoroughly in soap and water after contact and before eating or smoking.

8. Leakage -
 - a. Flow chamber gate: No liquid. Gas limited to 20 scim
 - b. Shaft seal: 5 scim, maximum
 - c. Control piston seals: 1 scim at 750 psig
 - d. External leakage: None
9. Response Time -
 - a. Closing time: 400 milliseconds at minus 320°F against 100 psig hydrostatic pressure
 - b. Opening time: 300 milliseconds at minus 320°F against a pneumatic pressure of 500 psig
10. Electrical Characteristics - Switch:
 - a. Contact resistance: 0.5 ohm maximum at 68°F
 - b. Insulation resistance: 50 megohms
 - c. Closed position: "Valve closed" switch shall actuate when gate is within 3 (plus 1.0, minus 2.0) degrees of fully closed position.
 - d. Open position: "Valve open" switch shall actuate when gate is within 5 ± 3 degrees of fully open position.

Thirty-eight failures were reported on Inspection Reports and one was reported on an Unsatisfactory Condition Report.



LOX BALL ROTOR SHUTOFF VALVE, 60C27830-1
SECTIONAL VIEW

SUMMARY SHEET	
Nomenclature Pre-Valve (Fuel)	
Drawing Numbers: 10414024, 20M30043 Saturn I Vehicle	Vendor: Parker Aircraft Co. North American Aviation Rocketdyne Div. Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $1,393 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 122 Total Number of Failures Reported: 31	MCBF (in cycles): 718.1 Total Cycles of Operation: 22,261 Vehicle Equipment: X Ground Equipment:

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out		Indicator Shows:
	Erratic	<u>1</u>	No Open
	Foreign Material		No Close
<u>3</u>	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
<u>2</u>	Inoperative		Broken/Ruptured:
<u>16</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>5</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
<u>3</u>	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-10 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Pre-Valve (Fuel)	
Drawing Numbers: 10414024 Saturn I Vehicle	Vendor: North American Aviation Rocketdyne Corp. Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $2,128 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 43 Number of Failures Reported: 15	MGBF (in cycles): 469.8 Total Cycles of Operation: 7,048* Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>300°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>5 g at 20 - 55 cps, 20 g at 110 - 2000 cps,</u> <u>0.03 in. D.A. at 55 - 110 cps</u>	

December 1965

* Minimum total, serial No. C-031, R-107-V,
R-122-V, R-130-V not shown in cycle logs.

II.7.2
Page 3 of 20

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out	<u>1</u>	Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
Would Not Close			
Pressure:			
None			
Low			
High			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-4 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC report IN-P&VE-E-62-5, dated 1962			

Additional information concerning the 10414024 valve:

The fifteen failures were reported on the Inspection Reports.

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MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414024 FUEL PRELIMINARY VALVE ASSEMBLY		1 September 1961
		PROCEDURE NO.: EP-140
		APPROVED <i>A. G. [Signature]</i>
		PAGE 1 OF 4

1. DESCRIPTION.

The fuel preliminary valve assembly 10414024 is a normally closed pneuma-mechanically operated gate type valve. The valve assembly is opened when the solenoid in the fuel and LOX MV-74V control valve 10414027 is energized to allow GN₂ from the control pressure system to pressurize the control port of the valve assembly. The valve is closed only in case of an emergency such as suction line failure or engine malfunction. A valve assembly is used in each of the eight fuel suction lines. Two fuel suction lines are located in the rear skirt of each 70-inch fuel container. The two valve assemblies in the rear skirt of container F1 are installed in the fuel suction lines of engines No. 1 and No. 5. The two valve assemblies in the rear skirt of container F2 are installed in the fuel suction lines of engines No. 2 and No. 6. The two valve assemblies in the rear skirt of container F3 are installed in the fuel suction lines of engines No. 3 and No. 7. The two remaining valve assemblies in the rear skirt of container F4 are installed in the fuel suction lines of engines No. 4 and No. 8. The location of the valve assemblies are shown in the installation view. The various functional characteristics of the valve assembly are as follows:

1.1 Mechanical Performance Characteristics. The valve assembly is capable of performing mechanically as follows:

- a. Line pressure: 45 p.s.i.g. maximum.
- b. Gate play: 1° maximum.
- c. Parallelism between the surface of the closed gate and the flat machined surface of valve housing: $\pm 0^\circ 30'$.
- d. Service: RP-1 Fuel.
- e. Internal leakage with 45 p.s.i.g. pressure in the line and the gate in both the open and closed positions alternately:
 - Shaft seals - 20 s.c.i.m. maximum.
 - Gate pin seals - 2 s.c.i.m. maximum.
 - Main seat - 25 s.c.i.m. maximum (applies only with gate in the closed position).
- f. External leakage: No leakage allowed.

1.2 Pneumatic Operating Characteristics. The valve assembly is capable of operating pneumatically as follows:

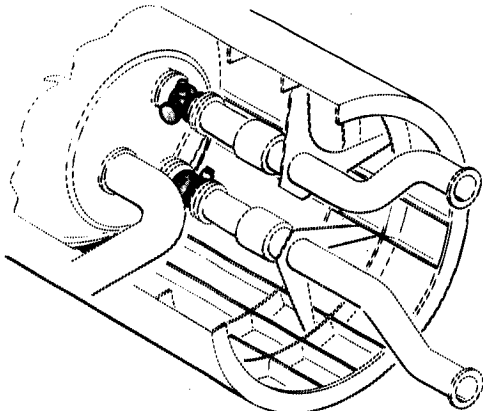
- a. Minimum operating pressure: 500 p.s.i.g. internal pneumatic pressure.
- b. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- c. Proof operating pressure: 1,125 p.s.i.g. internal pneumatic pressure.
- d. Burst pressure (without bursting): 1,875 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Operating media: Air, gaseous nitrogen, or helium.
- f. Leakage past the control cylinder: 5 s.c.i.m. maximum with 750 p.s.i.g. internal pneumatic pressure applied.

1.3 Electrical Performance Requirements. The electrical performance requirements of the valve assembly are as follows:

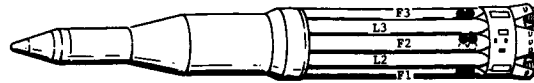
- a. Switch actuation: At $1^\circ \pm 0^\circ 30'$ before the gate is in its completely open or closed position.

10414024

MANUFACTURING PLAN



INSTALLATION VIEW - LOOKING FORWARD
(TYPICAL ON CONTAINERS F1, F2, F3, & F4)



GENERAL LOCATION

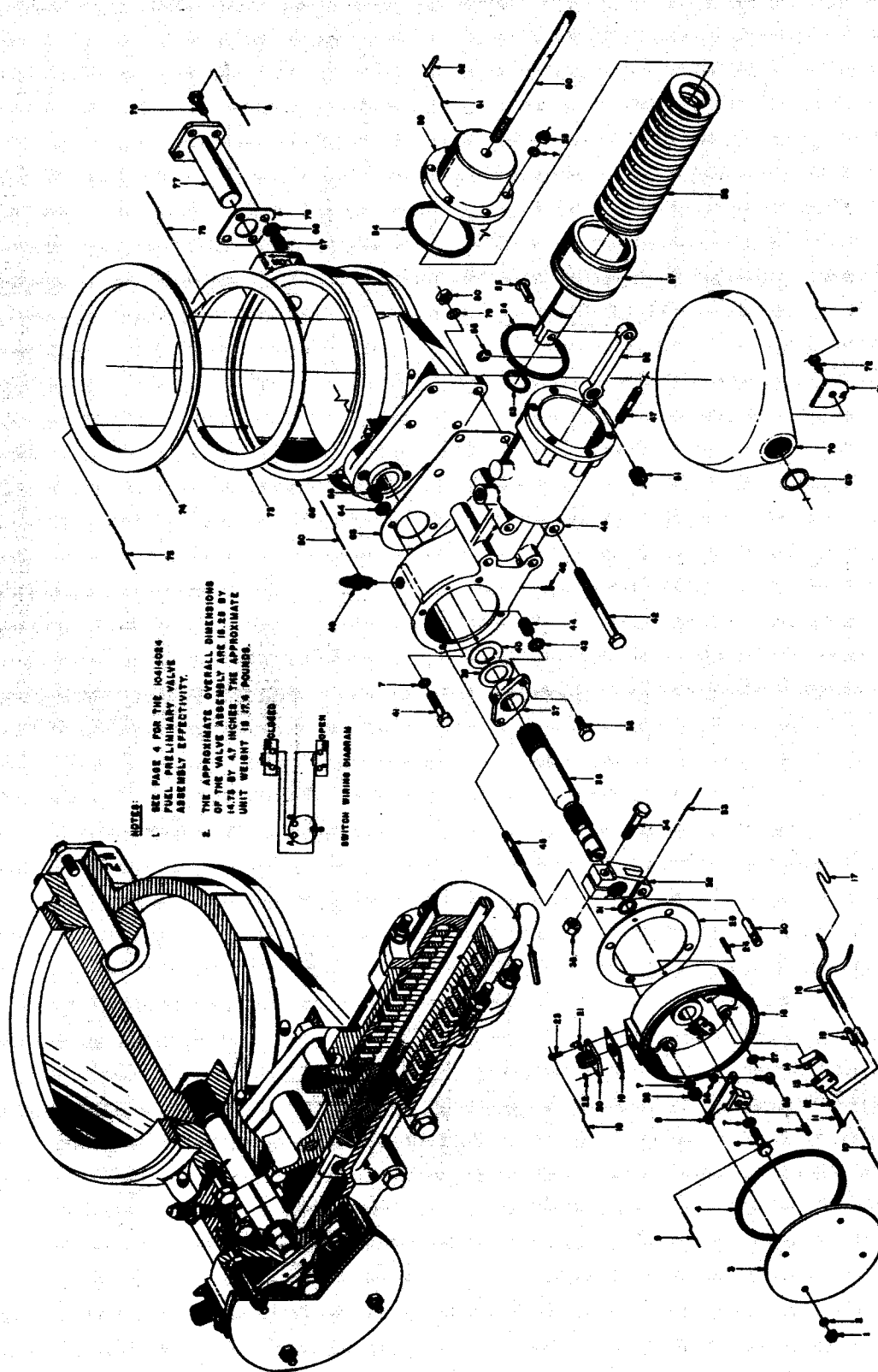
LEGEND

- 10414024 FUEL PRELIMINARY VALVE ASSEMBLY ("C" REV. 6 EO-5) (NORTH AMERICAN AVIATION INC., NO. 9512-48410-51) (A) (B) (C) (D) (E) (F)
1. NAS679A08W NUT (4 PLACES) (C) (F)
 2. 800-015-8 LOCK-O-SEAL (4 PLACES) (F)
 3. 9512-48065 COVER
 4. AN6230B22 PREFORMED PACKING (O-RING) (F) (H)
 5. MS20995N40 LOCKWIRE (J)
 6. AN4H10A BOLT
 7. 2W18-416 WASHER
 8. 9512-48425 VALVE SWITCH ARM ASSEMBLY
 9. 2P9-7-7 PIN
 9. 9512-48425-3 ARM
 9. 9512-48429 SWITCH ASSEMBLY
 10. AN995N20 LOCKWIRE (J)
 11. AN500A2-10 SCREW (4 PLACES) (L)
 12. 2W1C6-8-16 WASHER (4 PLACES)
 13. 28E6 MICRO SWITCH (MICRO SWITCH CORP.) (2 PLACES) (F)
 14. JE-1 ACTUATOR (MICRO SWITCH CORP.) (2 PLACES) (F)
 15. INSULATION TUBING
 16. ELECTRICAL WIRING
 17. TYING CORD (H)
 18. BOX
 19. 9615-48066 GASKET (BENDIX AVIATION CORP.) (F)
 20. 10-40450-10 CONNECTOR (REPLACES THE VENDOR FURNISHED AN3102E10SL3P CONNECTOR)
 20. MS3102E10SL3P LUG (REPLACES PART NO. R2-1-1) (F)
 21. RD191-4002-0001 WASHER (3 PLACES)
 22. 2W18-4 AN500A4-6 SCREW (4 PLACES) (N)
 23. AN122676 PIN
 24. 9612-48422 SETSCREW (2 PLACES)
 25. AN340-6 NUT (2 PLACES) (F)
 26. 2W1A117-20-62 WASHER (2 PLACES) (Q)
 27. NAS679A44Z NUT (H)
 28. 9615-48030 GASKET (R)
 29. 9615-48427 PIN (H)
 30. AN6227B9 PREFORMED PACKING (O-RING) (F) (H)
 31. 9512-48426 LEVER (S)
 32. MS20995N51 LOCKWIRE (J)
 33. AN5-12A BOLT
 34. NAS679A5 NUT (T)
 35. 9512-48431 SHAFT
 36. 9615-48024 RETAINER
 37. AN4-5A BOLT (2 PLACES) (U)
 38. 9615-48269 WASHER
 39. 9615-48062 SEAL (U) (V)
 40. AN4-11A BOLT (2 PLACES) (W)
 41. AN5-32A BOLT (4 PLACES)
 42. 9615-48013-51 PISTON HOUSING ASSEMBLY
 43. KR-6-1 RING (2 PLACES) (F)
 44. L1246-1-6 INSERT (2 PLACES) (F)
 45. 9615-48068 STUD (4 PLACES) (X)
 46. 9615-48013-9 CASTING
 47. 400496 STUD (6 PLACES) (X)
 48. 10414501 PIN
 49. 10414500 NIPPLE (REPLACES THE VENDOR FURNISHED AN816-4C NIPPLE) (Y)
 50. MS20995C32 LOCKWIRE (J) (Z)
 51. 9615-48266 BUSHING (R)
 52. 9512-48432 LINK (R)
 53. AN6227B13 PREFORMED PACKING (O-RING) (F) (H)
 54. AN6230B6 PREFORMED PACKING (O-RING) (F) (H)
 55. X5133-31M7 RING (WALDES KOHINOOR INC.) (F)
 56. 9512-48014 PIN (R)
 57. 402658 PISTON ASSEMBLY (H)
 58. 9-3226-11 SPRING
 59. 402656 CYLINDER CAP
 60. 402657 BOLT (AA)
 61. MS20995N32 LOCKWIRE (J)
 62. 20M30382 TAPER PIN (MAKE FROM MS26492-1550) (REPLACES THE VENDOR FURNISHED PIN AN385AH10P77)
 63. 9627-48497 GASKET
 64. 9512-48411 HOUSING ASSEMBLY
 65. RL28S8-8 RING (" PLACES) (F)
 66. RD206S8-6-5L INSERT (2 PLACES) (F)
 67. 9512-48411 HOUSING
 68. R206S8-8 INSERT (4 PLACES) (F)
 69. RL28S8-8 RING (4 PLACES) (F)
 70. 9512-48424 WASHER
 71. 9615-48591-3 GATE
 72. 9615-48074-3 WASHER
 73. AN3H3A BOLT (AB)
 74. 9615-48107 SEAL (H)
 75. 9512-48413 RING
 76. MS20995N91 LOCKWIRE (AC)
 77. 9512-48360 GASKET
 78. 9615-48020 BOLT (4 PLACES) (AD)
 79. 2W18-516 WASHER (4 PLACES) (T)
 80. NAS679A5 NUT (4 PLACES) (T)

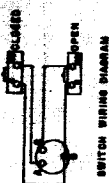
NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOK IN ACCORDANCE WITH MSFC-SPEC-106.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) OR APPROVED EQUIVALENT.
- (G) TORQUE 16 TO 20 INCH-POUNDS.
- (H) LUBRICATE WITH DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.
- (J) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (K) TORQUE 50 TO 70 INCH-POUNDS.
- (L) TORQUE 15 TO 18 INCH-POUNDS.
- (M) SPOT-TIE THE ELECTRICAL WIRES AT 3-INCH INTERVALS.
- (N) TORQUE 6 TO 8 INCH-POUNDS.
- (P) TORQUE 10 TO 12 INCH-POUNDS.
- (Q) INSTALL UNDER THE NUT PLACED HERE AND ON THE OPPOSITE SIDE OF THE BOX. INSTALL WASHER 2W18-416 UNDER THE TWO REMAINING NUTS.
- (R) TORQUE 50 TO 70 INCH-POUNDS.
- (S) POSITION THIS LEVER SO THAT THE SPLINE INDEX SCRIBE MARK IS IN LINE WITH THE PUNCH MARK SHOWN ON THE SHAFT.
- (T) TORQUE 100 TO 140 INCH-POUNDS.
- (U) TORQUE TO 50 INCH-POUNDS.
- (V) PRIOR TO INSTALLING THE VALVE GATE AND SHAFT, PLACE THIS SEAL BLANK IN THE CASTING 9615-48013-9 AND RETAIN WITH THE RETAINER 9615-48024. WITH BOTH HALVES TOGETHER, FORCE THE TOOL 365-798 THROUGH THE SEAL BLANK TO FORM THE SEAL. REMOVE THE TOOL AND SEAL TOGETHER. INSTALL THE SHAFT AND SLIP THE FORMED SEAL FROM THE TOOL TO THE SHAFT BY USING THE RETAINER 9615-48024.
- (W) TORQUE TO 43 INCH-POUNDS.
- (X) TORQUE 22 TO 30 INCH-POUNDS.
- (Y) TORQUE 130 TO 150 INCH-POUNDS.
- (Z) ADJUST SO THAT WHEN THE PISTON IS IN THE CLOSED POSITION THE GATE IS COMPLETELY CLOSED - TOP SURFACE OF THE GATE PARALLEL WITH THE TOP SURFACE OF THE GATE HOUSING WITHIN PLUS OR MINUS ZERO DEGREES 30 MINUTES.
- (AA) TORQUE 50 TO 55 INCH-POUNDS.
- (AB) TORQUE 20 TO 25 INCH-POUNDS.
- (AC) WIRE RING TO HOUSING TWO PLACES AS REQUIRED.
- (AD) TORQUE TO 85 INCH-POUNDS MAXIMUM.

DRAWN BY:	<i>J. Betts</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414024	REVISION DATE OF THIS PAGE
PLANNER:	<i>W. E. Brummett</i>		EO's -5	
WRITER:	<i>A. E. Plabank</i>			
APPROVED BY:	<i>M. K. Kistner</i>	C	ART CONTROL NO. M-F&AE-EP140-516-A	8 Dec. 1961



- NOTES:
1. SEE PAGE 4 FOR THE 10414084 FUEL PRELIMINARY VALVE ASSEMBLY EFFECTIVITY.
 2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 18.31" 14.73 BY 4.7 INCHES. THE APPROXIMATE UNIT WEIGHT IS 25.5 POUNDS.



b. The switch wiring diagram is shown on page 3.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

1.4 Shock Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.5 Vibration Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for five minutes duration in each of the three major axes under the following conditions:

- 20 to 55 c.p.s. at three g's
- 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
- 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Acceptance Test Requirements 10414124 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106
Rocketdyne - RA0113-001

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile Agency
ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10414124
10419909
10509302
10509303
10509305
10509311

EFFECTIVITY OF 10414024

VEHICLE	REVISIONS
SA-T	"C" Rev. and EO-5
SA-1	"C" Rev. and EO-5
SA-2	"C" Rev. and EO-5
SA-3	"C" Rev. and EO-5
SA-4	"C" Rev. and EO-5
Spares	Before installing modify to latest configuration

DATA SHEET	
Nomenclature: Pre-valve (fuel)	
Drawing Numbers: 20M30043	Vendor: Parker Aircraft Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $1,052 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 79 Number of Failures Reported: 16	MCBF (in cycles): 950.8 Total Cycles of Operation: *15,213 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: <u>55 to 93 g</u>	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>4 hr. at 165°F</u>	
Low Temperature: <u>-320°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop): <u>9 triangle waves at 35 g for 10 milliseconds</u>	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>5.0 g at 20-55 cps, 2.0 g at 110-2,000 cps, 3.0 g at 20-54 cps, 10.0 g at 110-2,000 cps, 102 in. D.A. at 55-109 cps, 0.03 in.D.A. at 55-110 cps (each for 5 minutes duration)</u>	

December 1965

(Revision)

* Minimum operating time. Serial numbers 231, 238, 229, 241, 249, 292, 274, 280 do not appear in time/cycle logs

II.7.2

Page 11 of 20

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>10</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>5</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports	
CALENDAR TIME DATA REPRESENTS:	SA-5 through SA-10 Vehicles (less flight data)
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report F61Q0017 Feb. 1, 1962, Parker Aircraft Co.	

Additional information concerning the Pre-valve (fuel) No.
20M30043 Component:

All sixteen failures were reported on Inspection Reports.

MSFC	MANUFACTURING ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE	PROCEDURE
TITLE		9 May 1963	MPI-2000
SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30043 FUEL BALL ROTOR SHUT-OFF VALVE		APPROVED <i>P. Gail</i>	PAGE 1 OF 4

1. DESCRIPTION.

The fuel ball rotor shut-off valve 20M30043 is a normally closed, spring loaded valve that is opened pneumatically by an integral control piston assembly. The valve is a component of the fuel suction line system and the fuel fill and drain system. One valve is used in each of the eight fuel suction lines and another is used in the fuel fill and drain line. In the fuel suction line system, the shut-off valve is opened when the solenoid in the fuel and LOX MV-74V control valve 20M30128 is energized to allow GN₂ from the control pressure system to pressurize the control port of the integral control piston assembly. The shut-off valve is closed only in case of an emergency such as suction line failure or engine malfunction. In the fuel fill and drain system, the shut-off valve is opened when ground source GN₂ pressurization admitted through the 1/4-inch quick disconnect coupling nipple 20M30136 is allowed to pressurize the control port of the integral control piston assembly. Two shut-off valves are located in the rear skirt of containers F1, F2, F3, and F4 in the fuel suction lines as shown in the installation view. An additional shut-off valve is located in the rear skirt of container F1 in the fuel fill and drain line as shown. The various functional characteristics of the shut-off valve are as follows:

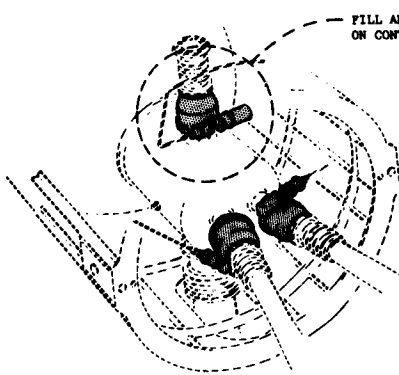
1.1 Mechanical Performance Characteristics. The shut-off valve is capable of performing mechanically as follows:

- a. Flow chamber operating media: RP-1 fuel.
- b. Control piston assembly operating media: Gaseous nitrogen, helium, or air.
- c. Gate opening method: Pneumatic pressurization.
- d. Gate closing methods: Primary - spring force. Alternate A - spring force and pneumatic pressurization. Alternate B - pneumatic pressurization solely. (NOTE: Selection of the operation method is possible by performing only minor modifications when the shut-off valve is installed.)
- e. Flow chamber operating pressure: 150 p.s.i.g. minimum internal pressure.
- f. Control piston assembly operating pressure: 750 p.s.i.g. nominal with 500 p.s.i.g. minimum.
- g. Flow chamber proof operating pressure: 225 p.s.i.g. minimum internal pressure.
- h. Control piston assembly proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure.

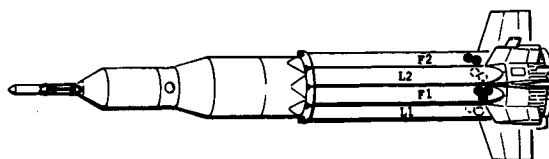
REVISION DATA

20M30043

- i. Flow chamber burst pressure (without rupture): 375 p.s.i.g. minimum internal hydrostatic pressure.
- j. Control piston assembly burst pressure (without rupture): 1,875 p.s.i.g. minimum internal pressure.
- k. Surge pressure withstanding capability: 100 surge pressure cycles from 0 to 300 to 0 p.s.i.g.
- l. Operating temperature range: -65° to +165° F.
- m. Pressure drop through flow chamber with RP-1 fuel flow rate of 3,250 g.p.m. at a density of 50.45 pounds per cubic foot: 1.0 p.s.i. maximum.
- n. Flow chamber gate seal liquid leakage: No liquid leakage, as evidenced by the formation of test medium droplets, with the preliminary valve inlet port pressurized from 0 to 150 p.s.i.g. with either RP-1 fuel or an approved substitute.
- o. Flow chamber gate seal gaseous leakage: 5 s.c.i.m. maximum gaseous leakage with the preliminary valve inlet port pressurized from 0 to 150 p.s.i.g. with GN₂.
- p. Flow control gate shaft seal leakage: 1.0 s.c.i.m. maximum with the flow chamber gate fully open and with the flow chamber pressurized from 0 to 150 p.s.i.g. with GN₂.
- q. Control piston assembly leakage: 1.0 s.c.i.m. maximum from either the opening or closing portion when they are pressurized from 0 to 750 p.s.i.g. with GN₂.
- r. External flow chamber leakage: None when pressurized from 0 to 150 p.s.i.g. with RP-1 fuel or GN₂. (NOTE: Flow from bleeds or vents is not considered leakage.)
- s. External control piston assembly leakage: None from either the opening or closing portion when they are pressurized from 0 to 750 p.s.i.g. with GN₂.
- t. Closing response time (measured from the open position switch indication to the closed position switch indication when the control pressure is vented and the gate is moved to the closed position by spring force): 200 ± 100 milliseconds when the flow chamber is pressurized to 100 p.s.i.g. with RP-1 fuel or an approved substitute under static or nominal flow conditions.
- u. Opening response time (measured from the closed position switch indication to the open position switch indication when control pressure of 500 p.s.i.g. is applied to the control piston assembly): 150 ± 50 milliseconds when the flow chamber is pressurized to 100 p.s.i.g. with RP-1 fuel or an approved substitute under static or nominal flow conditions.



INSTALLATION VIEW - LOOKING FORWARD
(TYPICAL ON CONTAINERS F1, F2, F3, AND F4)

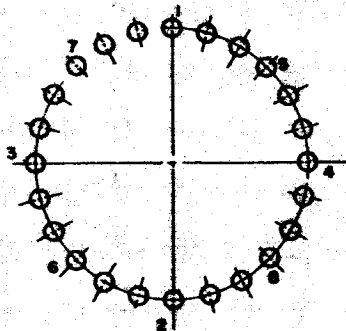


GENERAL LOCATION

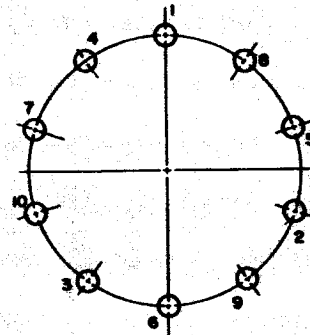
NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164 FOR FUEL OR PNEUMATIC SERVICE AS APPLICABLE.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PRE-FORMED RUBBER PACKING SEAL IN THE CONTROL ASSEMBLY IN ACCORDANCE WITH MSFC-STD-105.
- (D) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (E) OR APPROVED EQUIVALENT.
- (F) ANODIZE THE ALUMINUM SURFACES OF THE CONTROL PISTON ASSEMBLY GRAY AND THE FLOW CHAMBER RED IN ACCORDANCE WITH MIL-A-8625, TYPE II.
- (G) LOCKWIRE IN ACCORDANCE WITH MS33540 AND APPLY 3/8-INCH DIAMETER SEAL AFTER TESTING.
- (H) LUBRICATE THREADS WITH AR-1-F ANTISEIZE COMPOUND OR APPROVED EQUIVALENT.
- (J) USING THE TORQUE SEQUENCE SHOWN IN DETAIL A, TORQUE IN STEPS TO 50, 90, AND FINALLY 100 INCH-POUNDS. BAKE AT 160° F. FOR 3 HOURS, LET COOL TO ROOM TEMPERATURE, AND RETORQUE THE 8 NUMBERED BOLTS IN THE ORDER SHOWN AND THE 16 REMAINING BOLTS IN CLOCKWISE ORDER TO 100 INCH-POUNDS.
- (K) FLANGE SURFACES MUST BE PROTECTED FROM SCRATCHES DURING ASSEMBLY.
- (L) INSTALL IN ACCORDANCE WITH MS33646, CLASS 3B. REMOVE TANG AFTER ANODIZING THE FLANGE.
- (M) AFTER INSTALLING DO NOT ROTATE BALL PAST THE FULLY CLOSED OR FULLY OPEN POSITION.
- (N) DO NOT LUBRICATE.
- (P) USE BALL ASSEMBLY SHIELD TOOL TO PROTECT THE BALL DURING ASSEMBLY.
- (Q) BEFORE INSTALLING ITEMS 6.1 THRU 6.8, BURNISH WITH A TEFLON RING OR 6.25 I.D. HAVING APPROXIMATELY 0.015 x 45° CHAMFER ON THE I.D. APPLY A LOAD OF APPROXIMATELY 200 TO 250 POUNDS AND ACTUATE THE BALL FROM OPEN TO CLOSED TO OPEN 100 TIMES. REMOVE THE TEFLON BURNISHING RING AND THE LOOSE TEFLON PARTICLES FROM THE VALVE.
- (R) INSERT INTO BALL (ITEM 6.11) UNTIL TABS ENGAGE IN SLOTS AND GROOVE. THEN ROTATE UNTIL THE BALL HOLE MATES WITH THE PROJECTION ON THE LOWER BEARING SUPPORT (ITEM 6.13).
- (S) FLOW PATH IN TUBE (ITEM 6.12) MUST BE CONCENTRIC WITH BODY (ITEM 6.18.2) OUTLET PORT WITHIN 0.015-INCH. USE THE -3 SPACING RING TO OBTAIN THE INITIAL BALL POSITION. USE ANOTHER DASH NUMBER PART, IF REQUIRED, FOR ALINEMENT. THE LONGITUDINAL THICKNESS OF THE SPACING RING INCREASES BY 0.0125-INCH WITH EACH INCREASE IN DASH NUMBER.
- (T) USING THE TORQUING SEQUENCE SHOWN IN DETAIL B, TORQUE IN STEPS TO 50, 90, AND FINALLY 100 INCH-POUNDS. BAKE AT 160° F. FOR 3 HOURS, LET COOL TO ROOM TEMPERATURE, AND RETORQUE IN THE ORDER SHOWN IN DETAIL B TO 100 INCH-POUNDS.
- (U) INSTALL IN ACCORDANCE WITH MS33646 AND REMOVE TANG.
- (V) INSTALL IN ACCORDANCE WITH MS33646, CLASS 2B, AND REMOVE TANG.
- (W) TORQUE 60 TO 85 INCH-POUNDS AND INSTALL THE LOCKING KEY WITH THE TOP SURFACE OF THE STUD SHOULDER 0.010- TO 0.030-INCH BELOW SURFACE OF THE BODY.
- (X) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (Y) SELECT THE SPLINE AND GEAR TOOTH COMBINATION REQUIRED TO ALINE THE FLOW PASSAGE TO WITHIN ± 1° OF THE CENTERLINE OF THE BODY AND FLANGE WITH THE CONTROL ASSEMBLY IN THE OPEN POSITION.
- (Z) INSTALL IN ACCORDANCE WITH MS33646, CLASS 2, AND REMOVE TANG.
- (AA) LUBRICATE BY APPLYING A THIN FILM OF DOW-CORNING CORP. GREASE FS-1281 OR APPROVED EQUIVALENT.
- (AB) APPLY EVERLUBE CORP. EVERLUBE #811 AND BURNISH TO 0.0002- TO 0.0004-INCH THICKNESS.
- (AC) AFTER INSTALLING, FLARE THE CYLINDRICAL END TO 0.15-INCH DIAMETER.
- (AD) BEFORE INSTALLING THE BEARING (ITEM 8.6) AND PREFORMED PACKING (ITEM 8.7), FILL THE GROOVE TO 10X PACK WITH DOW-CORNING CORP. GREASE FS-1281. REMOVE EXCESSIVE LUBRICANT AFTER INSTALLING ITEMS 8.6 AND 8.7.
- (AE) INSTALL THE -1 PART FOR INITIAL CALIBRATION, THEN DETERMINE BY TESTING THE DASH NUMBER PART REQUIRED. THE -1 PART IS COLOR CODED RED, THE -2 PART GREEN, THE -3 PART BLUE, AND THE -4 PART GOLD. THE ORIFICE DIAMETER IS 0.061 ± 0.002, 0.072 ± 0.002, 0.080 ± 0.002, OR 0.086 ± 0.002 INCH FOR THE -1, -2, -3, OR -4 PART, RESPECTIVELY.
- (AF) COMPRESS THE SPRINGS WITH SPRING COMPRESSOR TOOL UNTIL THE EDGE OF THE SPRING PLATE (ITEM 10.12) IS WITHIN 0.06-INCH OF BEING FLUSH WITH THE HOUSING.
- (AG) INSTALL WITH INTERNAL GROOVE IN THE UP POSITION.
- (AH) POSITION THE SWITCH SHAFT TO PROVIDE ELECTRICAL CONTINUITY BETWEEN CONNECTOR PINS "A" AND "B" WITH THE VALVE IN THE CLOSED POSITION. ARROW ON SWITCH SHAFT MUST POINT TOWARD THE CONNECTOR.
- (AJ) STAKE TO RETAIN.
- (AK) INSTALL AFTER TESTING.
- (AL) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER FLANGE CONTACTS ITS MATING SURFACE.
- (AM) TORQUE EVENLY AND GRADUALLY TO 100 INCH-POUNDS.
- (AN) TORQUE 130 TO 180 INCH-POUNDS.

DRAWN BY:	<i>G. Bate</i>	ENGINEERING DRAWING RELEASE B	REVISION TO:	20M30043	REVISION DATE OF THIS PAGE
PLANNER:	<i>S. P. Phillips</i>		BO'S	-3	
WRITER:	<i>C. E. Schenk</i>		ART CONTROL NO.		M-ME-E-1186
APPROVED BY:	<i>M. Schickel</i>				



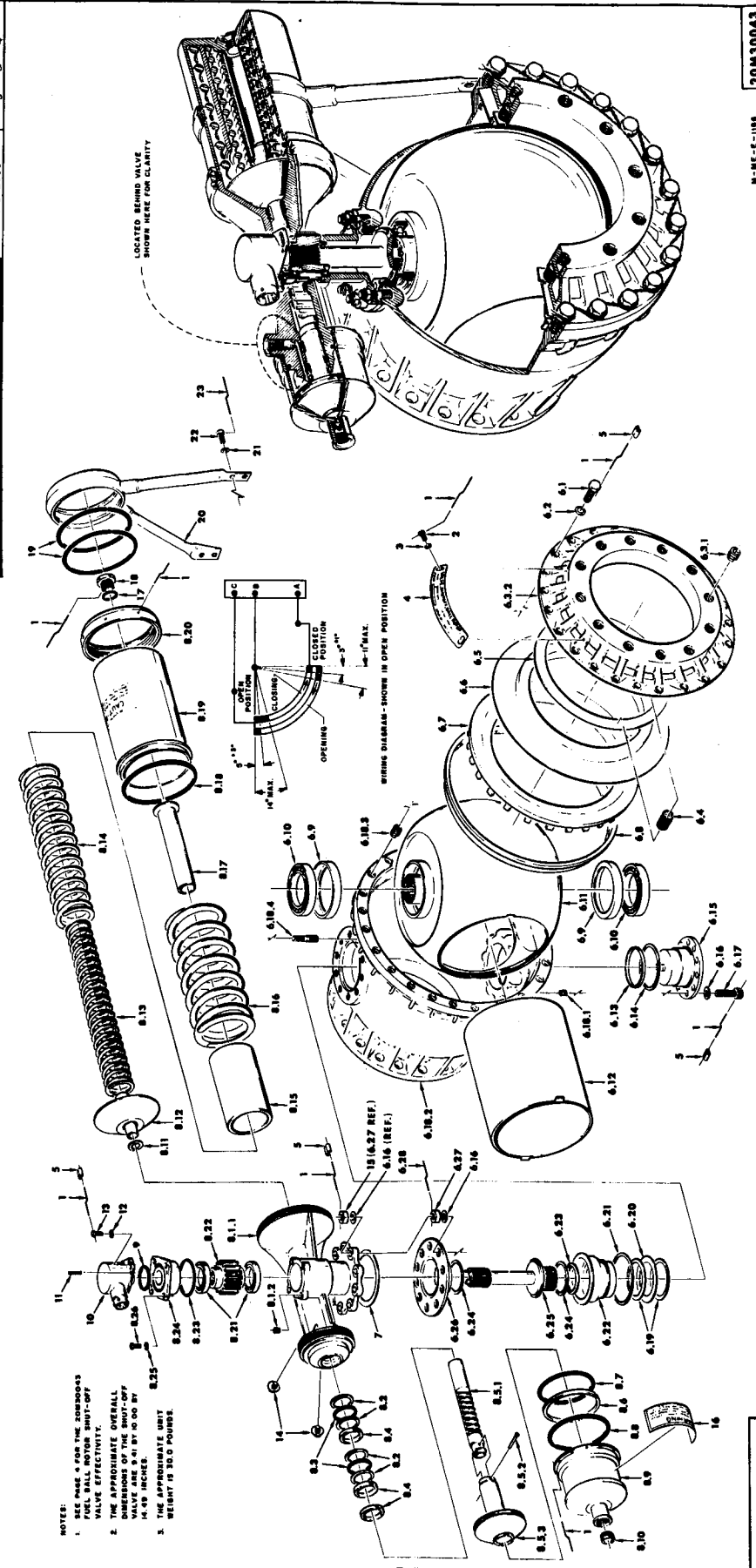
DETAIL A - 24 HOLE BOLT PATTERN TORQUING SEQUENCE



DETAIL B - 10 HOLE BOLT PATTERN TORQUING SEQUENCE

— LEGEND —

20K10043		FUEL BALL MOTOR SHUT-OFF VALVE (7" REV. & SO-3) (PARKER AIR- CRAFT CO., LOS ANGELES, CALIF., PART NO. P61C001001) (A) (B) (C)		P60W117K230 P60W117K037 P61C1521 P61C1543- () P61C1876 P61C1546 P61C1535 P61C1549 P62C1240 P61C1547 P61C1533 P60W117K043 P61C1533		PREFORMED PACKING (O-RING) (A) (AA) PREFORMED PACKING (O-RING) (B) (AB) CYLINDER (AA) ORIFICE (B) (AB) SPACER SPRING PLATE INNER SPRING (A) (AA) CENTRAL SPRING (A) (AA) LARGE SPRING SEAL (A) (AA) OUTER SPRING GUIDE INNER SPRING GUIDE PREFORMED PACKING (O-RING) (B) (AB) SPRING HOUSING (MADE FROM P61C1429) HOUSING RETAINER RING (B) PISTON GEAR BEARING (PAPER BEAR- ING CO., NEW BRITAIN, CONN., PART NO. A5410-01160) (A) (AA) PISTON GEAR (A) (AA) PREFORMED PACKING (O-RING) (B) (AB) PISTON BEARING SUPPORT WASHER (2 PLACES) SCREW (2 PLACES) (B) (AA) PREFORMED PACKING (O-RING) (B) (AA) 90° TRAVEL ROTARY SWITCH (NEWTON SWITCH INC., 2039) (A) (AA) CROOVED FIN (2 PLACES) (A) (AA) WASHER (2 PLACES) SCREW (2 PLACES) (B) (AA) VENT SEAL (INTERCHANGEABLE WITH VENT SEAL 20K10028 (SO-1)) (A) (AA) NUT (REFERENCE) (B) (AA) GREASE CAUTION TAG PREFORMED PACKING (O-RING) (B) (AA) PISTON (A) (AA) GASKET (A) (AA) SUPPORT ASSEMBLY WASHER (4 PLACES) SCREW (4 PLACES) (B) (AA) LOCKWIRE (A)	
1.	NS20995C32	LOCKWIRE (A)	8.7	P60W117K230		PREFORMED PACKING (O-RING) (A) (AA)	
2.	AK300AD4-6	SCREW (2 PLACES) (B)	8.8	P60W117K037		PREFORMED PACKING (O-RING) (B) (AB)	
3.	AP900CAL	WASHER (2 PLACES)	8.9	P61C1521		CYLINDER (AA)	
4.	P61C1527-2	NAMEPLATE	8.10	P61C1543- ()		ORIFICE (B) (AB)	
5.		3/8-INCH DIAMETER ALUMINUM SEAL	8.11	P61C1876		SPACER	
6.	P61C1647	FUEL VALVE ASSEMBLY	8.12	P61C1546		SPRING PLATE	
6.1	P61C1541	BOLT (24 PLACES) (B) (J)	8.13	P61C1535		INNER SPRING (A) (AA)	
6.2	P61C1690	INLET WASHER (24 PLACES)	8.14	P61C1549		CENTRAL SPRING (A) (AA)	
6.3	P61C1478	FLANGE ASSEMBLY (A)	8.15	P62C1240		LARGE SPRING SEAL (A) (AA)	
6.3.1	NS21200-P4-13	INSERT (12 PLACES) (B)	8.16	P61C1547		OUTER SPRING GUIDE	
6.3.2	P61C1478-1	FLANGE (MADE FROM UNSPECIFIED)	8.17	P61C1533		INNER SPRING GUIDE	
		FLANGE P61C1484 (A)	8.18	P60W117K043		PREFORMED PACKING (O-RING) (B) (AB)	
6.4	P61C1532	SPRING (36 PLACES)	8.19	P61C1533		SPRING HOUSING (MADE FROM	
6.5	P61C1530	SPRING RETAINING RING	8.20	P61C1530		P61C1429)	
6.6	P61C1529	SEAL (B)	8.21	P61C1712		HOUSING RETAINER RING (B)	
6.7	P61C1538	SEAL BACKUP	8.22	P61C1400		FINION GEAR BEARING (PAPER BEAR- ING CO., NEW BRITAIN, CONN., PART NO. A5410-01160) (A) (AA)	
6.8	P61C1480	SEAL RING	8.23	P60W117K029		FINION GEAR (A) (AA)	
6.9	P61C1557	TEMPERATURE COMPENSATOR	8.24	P61C1542		PREFORMED PACKING (O-RING) (B) (AB)	
6.10	P61C1504	2-9/16 O.D. BY 1-13/16 I.D. FULL TYPE BALL BEARING (APPROVED VENDOR, PAPER BEARING CO., NEW BRITAIN, CONN., PART NO. AK290-00004, "B" REV.) (B)	8.25	P61C1693		FINION BEARING SUPPORT	
		2-9/16 O.D. BY 1-13/16 I.D. FULL TYPE BALL BEARING (APPROVED VENDOR, PAPER BEARING CO., NEW BRITAIN, CONN., PART NO. AK290-00004, "B" REV.) (B)	8.26	AK301AD10-6		WASHER (2 PLACES)	
6.11	P61C1514	BALL (A) (AA)	9.	NS29513-24		SCREW (2 PLACES) (B) (AA)	
6.12	P61C1526	FLOW TUBE (A)	10.	P61C1503		PREFORMED PACKING (O-RING) (B) (AA)	
6.13	P61C1525- ()	SPACING RING (B)	11.	NS35672-6		90° TRAVEL ROTARY SWITCH (NEWTON SWITCH INC., 2039) (A) (AA)	
6.14	P61C1534-1	GASKET (TYPICAL)	12.	P61C1693		CROOVED FIN (2 PLACES) (A) (AA)	
6.15	P61C1524	LOWER BEARING SUPPORT (MADE FROM P61C2490)	13.	AK301AD10-6		WASHER (2 PLACES)	
		1/4 BOLT WASHER (10 PLACES)	14.	P61C1556		SCREW (2 PLACES) (B) (AA)	
6.16	P61C1492	BOLT (10 PLACES) (B) (V)	15.	P61C1533		PREFORMED PACKING (O-RING) (B) (AA)	
6.17	NS906A-06	BODY ASSEMBLY (A) (V)	16.	P61C1696		PISTON (A) (AA)	
6.18	P61C1476-2	INSERT (10 PLACES) (B)	17.	NS29512-6		GASKET (A) (AA)	
6.18.1	NS21200-P4-10	BODY (MADE FROM P61C1475)	18.	P61C1554		SUPPORT ASSEMBLY	
6.18.2	P61C1521-2	INSERT (24 PLACES) (V)	19.	P62C1334		WASHER (4 PLACES)	
6.18.3	NS21200-P5-13	STUD ASSEMBLY (NEWTON INSERT CO., LOS ANGELES 3, CALIF., PART NO. P-13) (10 PLACES) (B)	20.	P61C1970-1		SCREW (4 PLACES) (B)	
6.18.4	P61C1505-2	BELEVILLE SPRING	21.	AP60C100K		LOCKWIRE (A)	
		SPRING SPACING RING	22.	AK301AD10-6			
6.19	P61C1535	GASKET	23.	NS20995C32			
6.20	P61C1536	UPPER BEARING SUPPORT					
6.21	P61C1534-1	SHAFT SEAL (RACO ENGINEERING, SANTA MONICA, CALIF., PART NO. 11219)					
6.22	P61C1520	THROAT WASHER					
6.23	P61C1558	DRIVE SHAFT (MADE FROM P61C2417)					
		SHAFT RETAINER (MADE FROM P61C2407)					
6.24	P61C1530	NUT (MADE FROM AK315048) (B)					
6.25	P61C1539	LOCKWIRE (A)					
6.26	P61C1533	UPPER GASKET					
6.27	NS20995C32	CONTAINER ASSEMBLY (V)					
7.	P61C2333	ACTUATOR ASSEMBLY					
8.	2631608	BODY (MADE FROM P61C1522)					
8.1	P61C1523	INSERT (4 PLACES) (B)					
8.1.1	P61C1523-1	WATER RING					
8.1.2	NS21200-P1-10	PREFORMED PACKING (O-RING) (B) (AA)					
8.2	P61C1520	HOUSING					
8.3	NS20995C32	BACK AND PISTON ASSEMBLY					
8.4	P61C1239	BACK (A)					
8.5	2631599	PISTON LOCK PIN (A)					
8.5.1	P61C1479	PISTON (A)					
8.5.2	P61C1345	BEARING					
8.5.3	2631607						
8.6	2631606						



1.1 (con.)

- v. Life cycle performance capability: 1,000 cycles (closed to open to closed) of operation.
- w. Flow chamber relief differential pressure: 50 p.s.i. maximum at a GN₂ relief rate of 18 c.f.m. The GN₂ temperature range is -290° to -270° F.

1.2 Electrical Performance Requirements. The electrical performance requirements of the shut-off valve are as follows:

- a. Position indicating switch circuit resistance: 0.5 ohms maximum between the connector pins when their respective circuits are fully closed.
- b. Position indicating switch insulation resistance: 50 megohms minimum with 500 v.d.c. applied between each electrical connector terminal and the assembly housing or between any two terminals when their respective circuits are fully open.
- c. Position indicating switch closing actuation and deactuation positions: Actuation (possess continuity between electrical connector terminals "A" and "B") - $3^\circ \pm 1^\circ$ before the closing gate reaches its fully closed position. Deactuation (break continuity between electrical connector terminals "A" and "B") 11° maximum after the opening gate rotates from its fully closed position.
- d. Position indicating switch opening actuation and deactuation positions: Actuation (possess continuity between electrical connector terminals "B" and "C") - $5^\circ \pm 3^\circ$ before the opening gate reaches its fully open position. Deactuation (break continuity between electrical connector terminals "B" and "C") - 14° maximum after the closing gate rotates from its fully open position.
- e. The indicating switch wiring diagram is shown on page 2.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.3 Shock Withstanding Capability. The shut-off valve is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 50 g's in each of the three major axes:
- 10-milliseconds duration - triangular wave, or
 - 8-milliseconds duration - half sine wave, or
 - 5-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The shut-off valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions.

20 to 76 c.p.s. at 2.0 g's,
 76 to 190 c.p.s. at 0.0067-inch double amplitude displacement,
 190 to 2,000 c.p.s. at 12.5 g's, and
 20 to 2,000 c.p.s. at 0.10 g² per c.p.s. random vibration.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the shut-off valve are outlined in Performance Specification 10M01067 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-164
 Military - MIL-E-5272

3.2 Standards:

Military - MIL-STD-130
 MS33540
 NASA - MSFC-STD-105
 Army Ballistic Missile
 Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302
 MSFC - 10419909
 10M01067

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	"B" Rev. and EO-3
SA-6	"B" Rev. and EO-3
SA-7	"B" Rev. and EO-3
SA-8	"B" Rev. and EO-3
SA-9	"B" Rev. and EO-3
SA-10	"B" Rev. and EO-3
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30043

REVISION DATE

DATA SHEET	
Nomenclature: Valve (solenoid)vent	
Drawing Numbers: 20M30488	Vendor: Calmec Corp.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 2,000 cy.	
Failure Rate: 35,714 x 10 ⁻⁶ /cy.	MCBF (in cycles): 28
Number of Components this Data Represents: 1	Total Cycles of Operation: 39
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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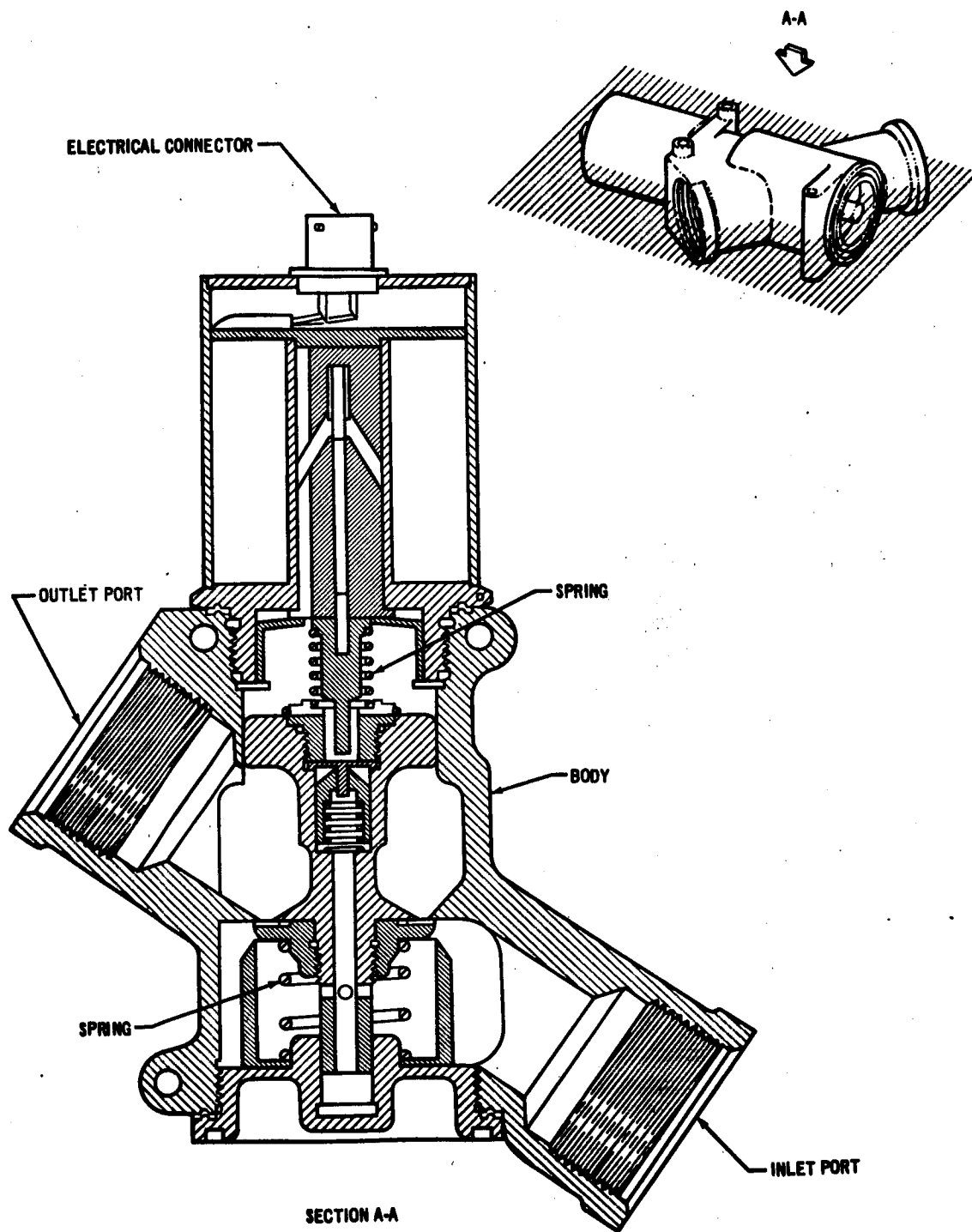
II.8.1.1
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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-7 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

SOLENOID VALVE, PART NO. 20M30488

The solenoid valve, in conjunction with the absolute-pressure switch, is used in inflight cooling to relieve excessive pressure caused by liquid boil-off of the nitrogen. The excess GN_2 is bled into the interstage compartment of the instrument unit.

1. VENDOR - CALMEC MFG. CORP., PART NO. 468
2. LOCATION - Tube No. 3
3. SERVICE - Air and GN_2
4. TEMPERATURE - Operating: 165 to -65°F
5. PRESSURE-
 - a. Operating: 17 psia
 - b. Proof: 25 psig
 - c. Burst: 45 psig
6. LUBRICATION - Lubricate seals and sliding surfaces with DC-55 grease (Dow Corning)
7. LEAKAGE-
 - a. External: No leakage allowed at operating pressure
 - b. Internal: 5 scim maximum at operating pressure
8. ELECTRICAL CHARACTERISTICS-
 - a. Operating voltage: 22 to 32 vdc with 28 vdc nominal
 - (1) 18 vdc maximum for poppet valve to open
 - (2) 5 vdc minimum for poppet valve to close
 - b. Insulation resistance: 500-volt megger test; 50 megohms minimum



SOLENOID VALVE, 20M30488 - SECTIONAL VIEW

DATA SHEET	
Nomenclature: Valve (solenoid) Vent	
Drawing Numbers: 20M30416	Vendor: Valcor Eng. Corp.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 2,000 cy.	
Failure Rate: 27,472 x 10 ⁻⁶ /cy.	MCBF (in cycles): 36.4
Number of Components this Data Represents: 5	Total Cycles of Operation: 182*
Number of Failures Reported: 5	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available.	
<p>Acceleration:</p> <p>Altitude:</p> <p>Radio Interference:</p> <p>Salt Spray:</p> <p>Shock:</p> <p>High Temperature:</p> <p>Low Temperature:</p> <p>Ambient Room Temperature:</p> <p>Thermal Shock:</p> <p>Shock Impact (Flat Drop):</p> <p>Leakage Rate:</p> <p>Humidity:</p> <p>Random Noise:</p> <p>Sine Wave Method:</p> <p>Vibration:</p>	
* Minimum total. Serial No. 8, and 13 not shown in cycle logs.	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>4</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		_____
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 and SA-6 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30416

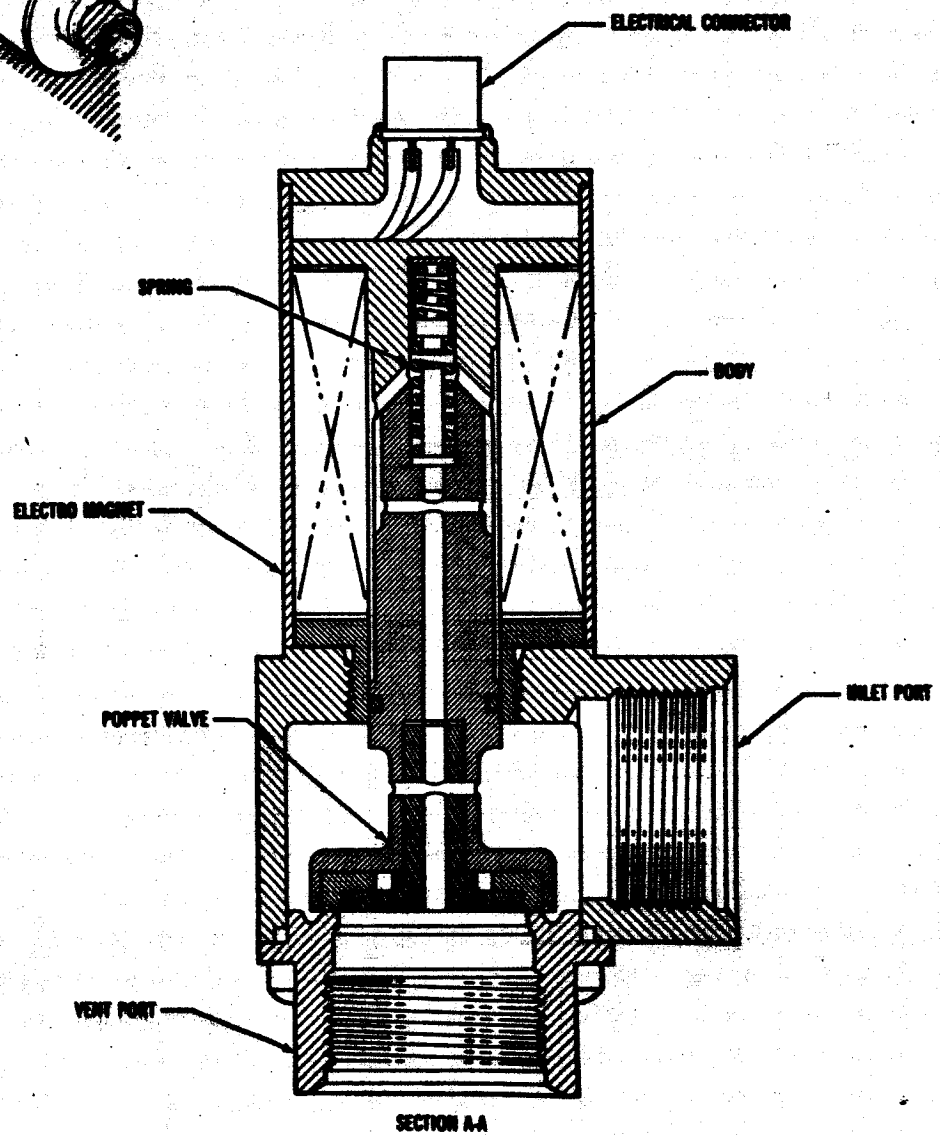
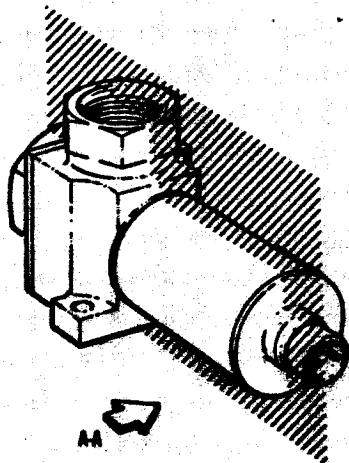
This valve is used to vent excessive pressure in the instrument compartment.

All five failures were reported on Inspection Reports.

SOLENOID VALVE, PART NO. 20M30416

The solenoid valve, in conjunction with the absolute-pressure switch, is used in inflight cooling to relieve excessive pressure caused by liquid boil-off of the nitrogen. The excess GN₂ is bled into the interstage compartment of the instrument unit.

1. VENDOR - VALCOR ENGINEERING CORP., PART NO. V-44800
2. LOCATION - Outer side of tube No. 3
3. SERVICE - Air and GN₂
4. TEMPERATURE - Operating: 165 to - 65°F
5. PRESSURE -
 - a. Operating: 17 psia
 - b. Proof: 25 psig
 - c. Burst: 42 psig
6. LUBRICATION - Lubricate seals and sliding surfaces with DC-55 grease (Dow Corning)
7. LEAKAGE -
 - a. External: No leakage allowed at operating pressure
 - b. Internal: 5 scim maximum at operating pressure
8. ELECTRICAL CHARACTERISTICS -
 - a. Operating voltage: 22 to 32 vdc with 28 vdc nominal
 - (1) 18 vdc maximum for poppet valve to open
 - (2) 5 vdc minimum for poppet valve to close
 - b. Insulation resistance: 500-volt megger test; 50 megohms minimum



SOLENOID VALVE, 20M30416 - SECTIONAL VIEW

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DATA SHEET	
Nomenclature: Valve (cooler vent)	
Drawing Numbers: 20M40072	Vendor: Valcor Engineering Corp.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 5,000 cy.	
Failure Rate: 3,875 x 10 ⁻⁶ /cy.	MCBF (in cycles): 258
Number of Components this Data Represents: 6	Total Cycles of Operation: 516
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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(Revision)

II.8.2

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
<u>1</u>	Inoperative		Broken/Ruptured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M40072 valve

Two failures were reported on Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 6 April 1963
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M40072 LN ₂ COOLER VENT VALVE		PROCEDURE MPI-2000
		APPROVED <i>P. S. [Signature]</i>
		PAGE 1 OF 4

1. DESCRIPTION.

The 2-way, 2-position, normally closed, solenoid operated, LN₂ cooler vent valve 20M40072 is a component of the in-flight operation instrument unit cooling system. The normally closed relief valve is opened when the thermistor located in the external fill line at the bypass valve indicates that the transfer line is sufficiently chilled to transfer liquid phase nitrogen. Simultaneously, the bypass valve is switched to the open position. LN₂ then begins to enter and fill the reservoir in the in-flight cooler assembly 20M40010. The vent valve is held in the open position to relieve LN₂ boil-off, when the reservoir is filling, by an override circuit until the in-flight cooling system is energized by the automatic sequencer. When the presence of liquid in the reservoir is sensed by either or both upper level thermistor assemblies 20M40130, the external LN₂ fill valve is signalled to return to the bypass position and the vent valve is closed. The LN₂ supply is replenished as described above when the lower level thermistor assembly 20M40131 indicates the absence of LN₂ in the reservoir. The vent valve is located in the 154-inch-diameter instrument unit assembly as shown in the installation view. The various functional characteristics of the vent valve are as follows:

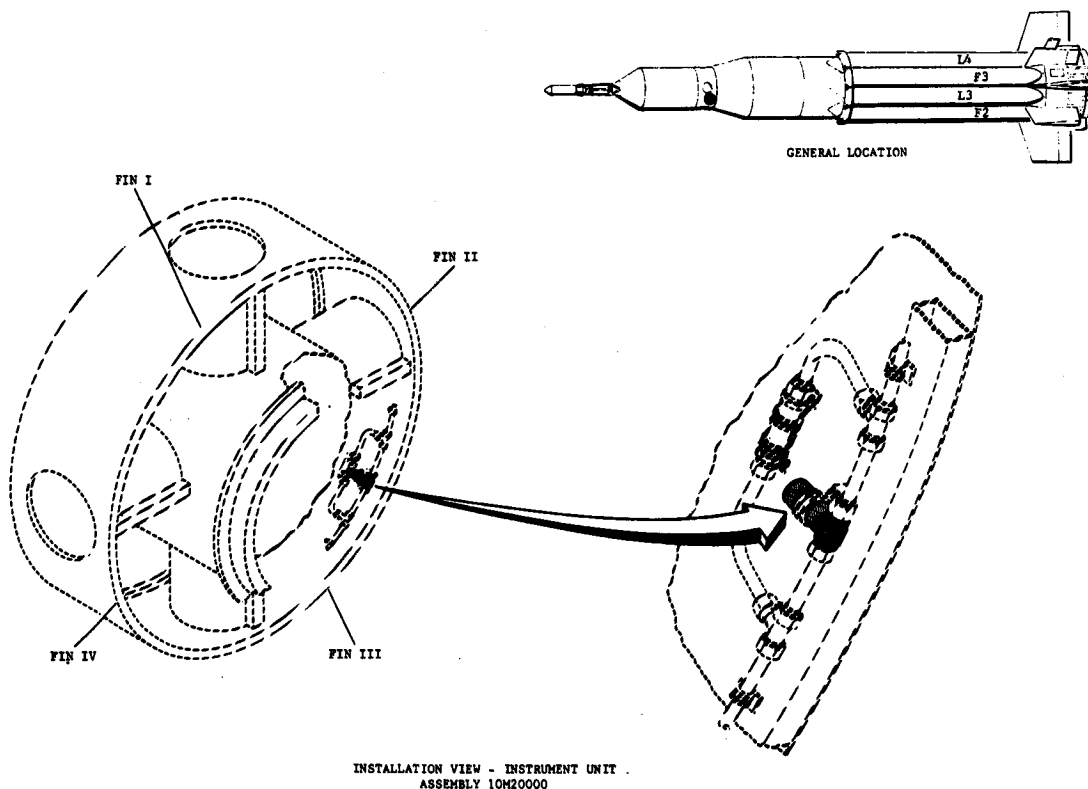
1.1 Mechanical Performance Characteristics. The vent valve is capable of performing mechanically as follows:

- a. Service media: LN₂ or GN₂.
- b. Nominal operating pressure: 30 p.s.i.g. internal pressure.
- c. Proof operating pressure: 45 p.s.i.g. minimum internal pressure.
- d. Burst pressure (without bursting): 75 p.s.i.g. minimum internal pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Operating temperature ranges: Internal - -320° to +125° F.
External - 0° to +125° F.
- f. Flow capacity equivalent: A sharp-edged orifice of 0.85-inch minimum diameter.
- g. External leakage: None allowed with an internal pressure of 45 p.s.i.g. applied.
- h. Seat leakage: Liquid - None with an inlet LN₂ pressure of 45 p.s.i.g. applied. Gaseous - 5 s.c.i.m. maximum with an inlet pressure of 45 p.s.i.g. applied.
- i. Life cycle: 5,000 minimum operating cycles without damage or impairment of performance.

1.2 Electrical Performance Characteristics. The electrical performance characteristics of the vent valve are as follows:

- a. Operating voltage: 24 to 30 v.d.c. with 28 v.d.c. nominal.
- b. Maximum operating current with 50 p.s.i.g. pressure applied to the inlet port and a supply voltage of 30 v.d.c.: To open - 7.5 a.
To remain open - 2.0 a.
- c. Solenoid continuous duty performance requirements: 4 hours with 28 ± 2 v.d.c. applied.
- d. Insulation resistance: 50 megohms minimum with 250 v.d.c. applied between each isolated electrical connector terminal and the valve body or between the terminals of the electrical connector when the internal circuits are fully open.

REVISION DATE



NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSPC-SPEC-164.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) OR APPROVED EQUIVALENT.
- (D) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (E) STAMP THE CURE DATE OF THE OLDEST PRE-FORMED RUBBER SEAL IN ACCORDANCE WITH MSPC-STD-105.
- (F) COMPONENT PARTS OF THIS ASSEMBLY ARE MATCHED, DISASSEMBLY AND SUBSTITUTION OF COMPONENTS MAY IMPAIR PERFORMANCE.
- (G) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (H) TORQUE 6 TO 8 INCH-POUNDS.
- (J) LOCATE WITH THE KEYWAY IN THE POSITION SHOWN.
- (K) ASCERTAIN THAT BENDIX GASKET PART 10-330914-141 IS INSTALLED IN THIS RECEPTACLE.
- (L) LUBRICATE WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE 2 POWDER OR APPROVED EQUIVALENT.
- (M) INERT GAS WELD TO BODY.

20M40072

1. V-41615-02
- 1.1 MS20995C20
- 1.2 AN300AD4-4
- 1.3 PTO2E-14-3P
- 1.4 S101AL19
2. V-41604
3. V-41633
4. V-41603
5. V-41610-02
6. V-41611
7. V-41639
8. V-5013-02
9. V-41602

LN₂ COOLER VENT VALVE ("A" REV.)
(VALCOR ENGINEERING CORP., KENILWORTH,
N. J., PART V-41600-02) (A) (B) (C)

(D) (E) SOLENOID ASSEMBLY (F)
LOCKWIRE (G)
SCREW (#4-40) (4 PLACES) (H)
RECEPTACLE (BENDIX CORP.) (C) (J) (K)
PREFORMED PACKING (O-RING) (L)
PLUNGER SPRING
PLUNGER PIN (L)
PLUNGER (L)
BODY (MADE FROM PART V-41600) (M)
SEAT
RETAINER
SEAL DISC SPRING
SEAL DISC (L)

DRAWN BY:

PLANNER:

WRITER:

APPROVED BY:

ENGINEERING
DRAWING
RELEASE

A

REVISION TO:

20M40072

BO'S

ART CONTROL NO.

M-ME-E-1065

REVISION
DATE OF
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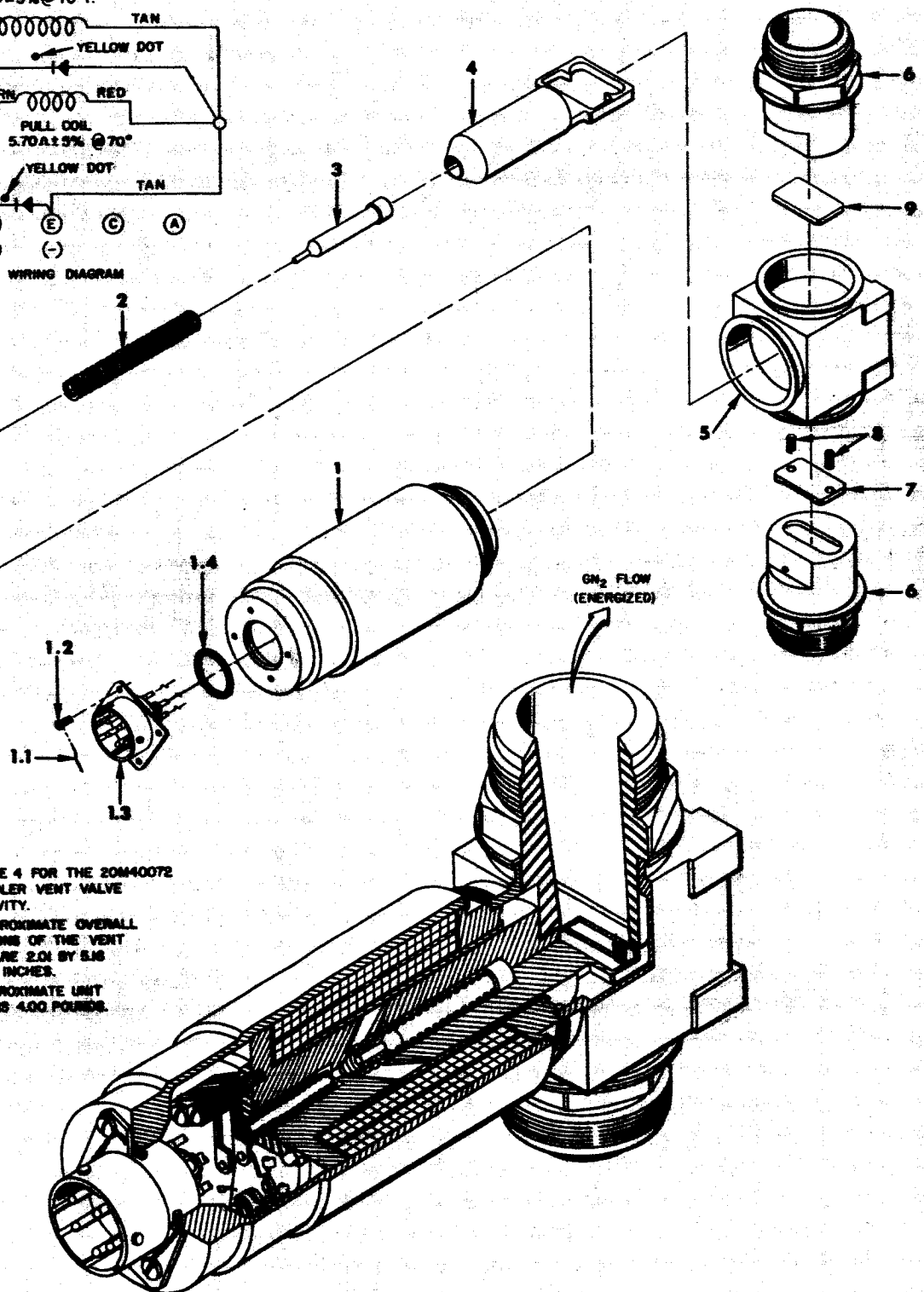
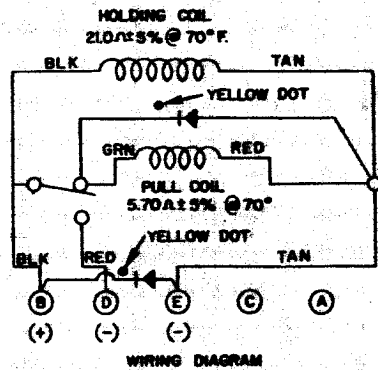
MANUFACTURING PLAN

PROCEDURE

MPI-2000

PAGE

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NOTES:

1. SEE PAGE 4 FOR THE 20M40072 LN₂ COOLER VENT VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VENT VALVE ARE 2.01 BY 5.16 BY 7.00 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 4.00 POUNDS.

REVISION DATE

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20M40072

MSFC	MANUFACTURING ENGINEERING DIVISION		NASA
PAGE	PROCEDURE	MANUFACTURING PLAN	
4 OF 4	MPI-2000		

1.2 e. Minimum operating voltage with 50 p.s.i.g. inlet pressure applied:
To fully open with increasing voltage - 18 v.d.c. maximum. To
return to the fully closed position on decreasing voltage - 3
v.d.c. minimum.

f. Response time (opening or closing) with 28 v.d.c. applied: 100-
milliseconds maximum.

g. Position switch indication: Indicates that the valve is in the open
position by showing electrical continuity between connector pins
"B" and "D" with a circuit resistance of not greater than 0.5 ohm.

h. The wiring diagram is shown on page 3.

CAUTION: Paragraphs 1.3, 1.4, and 1.5 constitute destructive test items
that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The vent valve is designed to withstand,
without damage or impairment of performance, six shocks (three in each
direction) of one of the following durations and wave forms at 20 g's
in each of the three major axes with the valve deenergized and the inlet
port pressurized to 30 p.s.i.g. with LN₂:
10-milliseconds duration - triangular wave, or 8 milliseconds dura-
tion - half sine wave, or 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The vent valve is designed to with-
stand, without damage or impairment of performance, vibration at each
resonant frequency for 10 minutes duration in each of the three major
axes with the valve deenergized and the inlet port pressurized to 30
p.s.i.g. with LN₂ under the following conditions:
20 to 45 c.p.s. at 1.0 g's, 45 to 95 c.p.s. at 0.01-inch double
amplitude displacement, and 95 to 2,000 c.p.s. at 5.0 g's.

1.5 Acceleration Withstanding Capability. The valve is designed to withstand
acceleration loading, without damage or impairment of performance, while
deenergized and with the inlet port pressurized to 30 p.s.i.g. with LN₂
as follows: 2 g's along each major lateral axis (in both directions),
and 8 g's along the longitudinal axis (in flight direction only).

2. TEST AND DELIVERY REQUIREMENTS.
The destructive and nondestructive acceptance tests and the preparation for
delivery of the vent valve are outlined in Performance Specification 10M01211
and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 <u>Specifications:</u>	3.2 <u>Standards:</u>
Military - MIL-E-5272, & MIL-I-618	Military - MIL-STD-130 & MS33540
NASA - MSFC-PROC-158, & -SPEC-164	NASA - MSFC-STD-105

3.3 Drawings:
Ordnance Corps - 10509302; MSFC - 10M01211

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	"A" Rev.
SA-6	"A" Rev.
SA-7	"A" Rev.
SA-8	"A" Rev.
SA-9	"A" Rev.
SA-10	"A" Rev.
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M40072

REVISION DATE

SUMMARY SHEET	
Nomenclature Valves, Fuel Vent	
Drawing Numbers: 10414021, 20M30000	Vendor: Chrysler
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy	
Failure Rate: $1459 \times 10^{-6}/\text{cy}$ Total Number of Components this Data Represents: 30 Total Number of Failures Reported: 11	MCBF (in cycles): 685 Total Cycles of Operation: 7535 Vehicle Equipment: X Ground Equipment:

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out	<u>5</u>	Indicator Shows:
<u>3</u>	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>1</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		_____
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valves, Fuel Vent	
Drawing Numbers: 10414021	Vendor: Chrysler
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 535 x 10 ⁻⁶ /cy.	MCBF (in cycles): 1,866
Number of Components this Data Represents: 10	Total Cycles of Operation: 1,866
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>165°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20-55 cps at 5 g, 55-110 cps at 0.016 in. D.A.d.</u> <u>110-2,000 cps at 20 g.</u>	

December 1965

11.8:3
Page 3 of 11

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-2 through SA-4 Vehicles (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-62-5, 21 Jan. 62, NASA/MSFC			

DATA SHEET	
Nomenclature: Valves, Fuel Vent	
Drawing Numbers: 20M30000	Vendor: Chrysler
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $1,763 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 20 Number of Failures Reported: 10	MCBF (in cycles): 566.9 Total Cycles of Operation: 5669 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: (See page 7)	
High Temperature: <u>160°F</u>	
Low Temperature: <u>0°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: (See page 7)	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: (See page 7)	

December 1965

II.8.3
Page 5 of 11

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic	<u>5</u>	No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
<u>2</u>	Inoperative		Broken/Runtured:
<u>2</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>1</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Chrysler Report No. ME-M194-S177, 23 September 1963			

Additional information concerning Fuel Vent Valve 20M30000:

Six failures were reported on Inspection Reports and five were reported on Unsatisfactory Condition Reports.

Environmental Tests:

Shock: Six shocks in each axis (3 in each direction half sine pulse of 35 g magnitude and 8 milliseconds duration).

Leakage Rate: Control cylinder pressure leakage at 750 psig, 5 scim max., cracking pressure leakage 19 ± 0.5 psig, 150 scim minimum. Reseat pressure 17 psig minimum with 20 scim maximum leakage.

Vibration: 10-minute sweep in each axis at 20-30 cps at 0.2 in. D.A. displacement. 38-220 cps at 15 g peak. 220-400 cps at 0.0062 in. D.A. displacement. 400-2,000 cps at 50 g peak (5 minutes vibration at each resonant frequency at $1/2$ the sine sweep level.

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN			DATE	PROCEDURE NO.	
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30000 FUEL VENT VALVE ASSEMBLY			28 December 1961	MPI-2000	
			APPROVED <i>[Signature]</i>	PAGE 1 OF 4	

1. DESCRIPTION.

The fuel vent valve assembly 20M30000 is a dual purpose normally closed pneumatic override and pressure operated poppet valve. The valves pneumatic override feature is ground controlled to open the valve poppet during both the filling and draining operations. The pressure actuated feature of the valve is used to relieve overpressurization of the fuel container during flight or at any time that the valve poppet is not held open by its pneumatic override feature. The valve assembly is installed on fuel containers F3 and F4 in the 4-inch vent assembly as shown in the installation view. The various functional characteristics of the fuel vent valve are as follows:

1.1 Venting Characteristics. When the fuel container is pressurized with gaseous nitrogen to 30 p.s.i.g., the flow of gaseous nitrogen through the valve is a minimum of 2 pounds per second at an ambient temperature of 50 degrees F. The valve vents at a maximum rate of 150 s.c.i.m. when a pressure of 19 plus or minus 0.5 p.s.i.g. is applied to the valve housing. The poppet reseats when the pressure is decreased to 17 plus or minus 0.5 p.s.i.g. with a maximum leakage of 20 s.c.i.m. at the reseating pressure. The venting feature is capable of performing as follows:

- a. Temperature range: 0° to +160° F.
- b. Service medium: RP-1 fuel vapor and gaseous nitrogen.
- c. Housing operating pressure: 40 p.s.i.g. static internal pneumatic pressure.
- d. Housing proof operating pressure: 60 p.s.i.g. static internal pneumatic pressure.
- e. Housing burst pressure (without bursting): 100 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)

1.2 Pneumatic Override Characteristics. The pneumatic override feature is capable of performing as follows:

- a. Service medium: Gaseous nitrogen.
- b. Minimum operating pressure: 500 p.s.i.g.
- c. Nominal operating pressure: 750 p.s.i.g. without leakage.
- d. Proof operating pressure: 1,125 p.s.i.g.
- e. Burst pressure (without bursting): 1,875 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
- f. Leakage past control piston and electrical connector: 5 s.c.i.m. maximum with 750 p.s.i.g. on control cylinder.

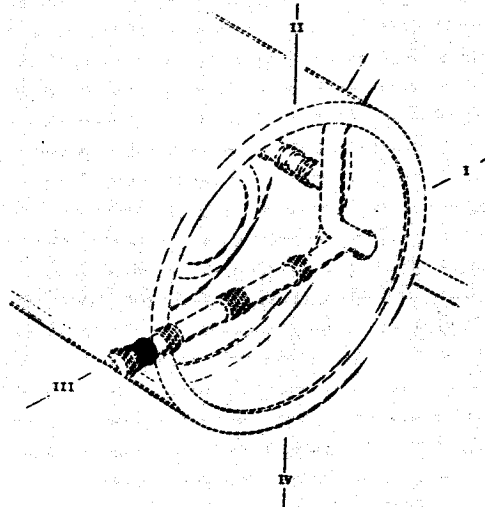
1.3 Electrical Performance Characteristics. The switch assembly indicates that the valve is closed when the poppet is within a range of 0.010- to 0.100-inch of its fully closed position. A continuity check between electrical connector pins "A" and "B" with the valve in the closed position must indicate less than 0.5 ohms resistance. With the valve poppet in the fully open position the insulation resistance between electrical connector pin "B" and the valve body and pins "A" and "B" must be a minimum of 50 megohms.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

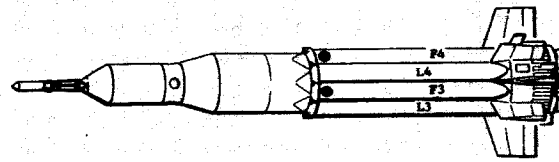
REVISION DATE
20 JUL 1962

(Continued on page 4)

20M30000



INSTALLATION VIEW - LOOKING AFT
(TYPICAL ON CONTAINERS F3 AND F4)



GENERAL LOCATION

LEGEND

20M30000

FUEL CONTAINER VENT VALVE ASSEMBLY
(EO-1A, -2A, -3A, & -4A)

- A CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
- B IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- C STAMP THE CURS DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- D TORQUE 25 TO 35 INCH-POUNDS.
- E LUBRICATE WITH DOW CORNING CORP. FLUOROSILICONE GREASE, QC-2-0026 OR APPROVED EQUIVALENT.
- F OR APPROVED EQUIVALENT.
- G LOCKWIRE IN ACCORDANCE WITH MS33540.
- H MOLD AND CURE IN PLACE (RUBBER, MIL-R-3065, GRADE SS-715, A₁B₁E₁, BUNA N).
- J RADIOGRAPHICALLY INSPECT IN ACCORDANCE WITH ASMA-STD-41.
- K HYDROSTATICALLY TEST CASTING AT 100 P.S.I.G. AFTER MACHINING. PNEUMATICALLY TEST THE MACHINED CASTING AT 100 P.S.I.G. UNDER WATER FOR 5 MINUTES. THE APPEARANCE OF ANY BUBBLES DUE TO CASTING IMPERFECTIONS CONSTITUTES CAUSE FOR REJECTION.
- L TORQUE 130 TO 170 INCH-POUNDS.
- M TORQUE 130 TO 250 INCH-POUNDS.
- N MALCOLMIZE AS REQUIRED.
- P ADJUST RETAINER UNTIL POPPET OPENS AT 19 ± 0.5 P.S.I.G. AND CLOSURE AT 17 ± 0.5 P.S.I.G.

- Q TORQUE 160 TO 190 INCH-POUNDS.
- R TORQUE 700 TO 1,000 INCH-POUNDS.
- S MAINTAIN A CLEARANCE OF 0.01 TO 0.05-INCH BETWEEN SHAFT AND PISTON WHEN VALVE POPPET IS CLOSED.
- T IF THE MAGNETIC SWITCH DOES NOT ACTUATE PROPERLY, REMOVE THE FOUR MAGNET SPACERS AND FOUR BAR MAGNETS FROM THE PISTON AND CUT OFF A SMALL PORTION OF THE SPACERS. INSERT THE CUT OFF PORTION OF THE SPACERS, THE MAGNETS, AND FINALLY THE REMAINDER OF THE SPACERS. THE AMOUNT TO BE CUT OFF AND INSERTED BEFORE THE MAGNETS MAY VARY DUE TO MAGNET CHARACTERISTICS.
- U HYDROSTATICALLY TEST THE OVERRIDE CYLINDER AT 1,125 P.S.I.G. PNEUMATICALLY TEST THE OVERRIDE CYLINDER AT 1,125 P.S.I.G. UNDER WATER FOR 5 MINUTES. THE APPEARANCE OF ANY BUBBLES DUE TO CASTING IMPERFECTIONS CONSTITUTES CAUSE FOR REJECTION.
- V CONTINUE TURNING 1/4 TO 1/2 TURN AFTER PLANCE CONTACTS THE HOUSING.
- W TORQUE 350 TO 400 INCH-POUNDS.
- X ADJUST TO ENDGAGE THAT THE VALVE IS CLOSED WHEN THE POPPET IS WITHIN 0.100-INCH MAXIMUM AND 0.010-INCH MINIMUM OF SEATING.
- Y SOLDER CONNECTIONS IN ACCORDANCE WITH MSFC-PMO-158.

1. 20M30027 ACORN NUT (A) (B) (C)
2. 20M30035 POPPET SEAL (PRECISION RUBBER PRODUCTS CORP., 110-3/8) (E) (F)
3. MS20995C41 LOCKWIRE (G)
4. 20M30026-2 DECAL
5. 20M30026-1 DECAL
6. 20M30010 POPPET (EO-1)
7. 20M30004 POPPET HOUSING ASSEMBLY (EO-1)
- 7.1 20M30004-1 SEAL (H)
- 7.2 20M30023 LOCK RING (ROSEAN INC., RL248B-7) (8 PLACES) (F)
- 7.3 20M30024 STUD (ROSEAN INC., SF101-9SA-10) (8 PLACES) (F)
- 7.4 20M30025 BUSHING
- 7.5 20M30002 POPPET HOUSING (EO-1) (J) (K)
8. MS20365D524C NUT (8 PLACES) (L)
9. AN960PD516 WASHER (8 PLACES)
10. 20M30040-8 K-SEAL (HARRISON MANUFACTURING CO., 12100CBA) (F)
11. MC179D6W FLNG AND BLENDER
12. 20M30017 SHAFT (A) (B)
13. 20M30038 SPRING
14. 20M30216 SPRING RETAINER
15. MS134357 BALL (11 PLACES)
16. 20M30215 RETAINER (P)
17. 20M30011 TAB WASHER
18. MS35690-630 NUT (Q)
19. 20M30015 PISTON STOP (EO-1) (R)
20. 20M30040-2A K-SEAL (HARRISON MANUFACTURING CO., 12100CBA) (F)
21. 20M30019 PISTON (S) (T)
22. 20M30032 MAGNET SPACER (4 PLACES) (U)
23. 20M30030 BAR MAGNET (REVERE CORP. OF AMERICA, F-6972-3) (F)
24. 20M30029 PISTON WASHER
25. 20M30034 RETAINING RING
26. MS29513-215 PREFORMED PACKING (O-RING) (V) (W) (X) (Y) (Z)
27. MS29513-243 PREFORMED PACKING (O-RING)
28. 20M30001 CYLINDER (EO-1, -2, & -3) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z)
29. AN50011 BOLT (8 PLACES)
30. 20M30028 VENT SEAL (EO-1)
31. 20M30031 CASSET (RAYNETOS MANHATTAN INC., K-68) (F)
32. 20M30012 ELECTRICAL CONNECTOR (CANNON ELECTRIC CO., G802-10SL-4P-111) (F)
33. MS35275-15 SCREW (4 PLACES)
34. MS20995C21 LOCKWIRE (G)
35. 20M30040-4 K-SEAL (HARRISON MANUFACTURING CO., 12100CBA) (F)
36. 20M30405 ORIFICE REDUCER ASSEMBLY (V)
- 36.1 20M30406 REDUCER (EO-1) (WAKE FROM MC182B7W)
- 36.2 20M30404 ORIFICE
37. 20M30005 SWITCH ASSEMBLY (EO-1)
- 37.1 20M30006 SWITCH HOLDER (EO-1) (X)
- 37.2 20M30008 SWITCH CUP (EO-1)
- 37.3 20M30007 SWITCH (REVERE CORP. OF AMERICA, K5400-23 OR -33) (F)
- 37.4 20M30214 SWITCH INSULATOR
- 37.5 ELECTRICAL WIRING (MIL-W-16678, TYPE B, NICKEL PLATED AND NO. 22) (Z)
38. MS29512-6 PREFORMED PACKING (O-RING) (E) (F)
39. 20M30013 BACKUP WASHER (EO-1)
40. 20M30014 SWITCH NUT
41. 20M30018 CAP (EO-1) (A)

DRAWN BY:	J. B. Bette	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30000	REVISION DATE OF THIS PAGE
PLANNER:	Wm. G. Bennett		EO's -1A, -2A, -3A, AND -4A	
WRITER:	B. G. Crawford			
APPROVED BY:	M. J. Bette		ART CONTROL NO. M-ME-E-592-E	28 Jun 1963

MANUFACTURING PLAN

PROCEDURE

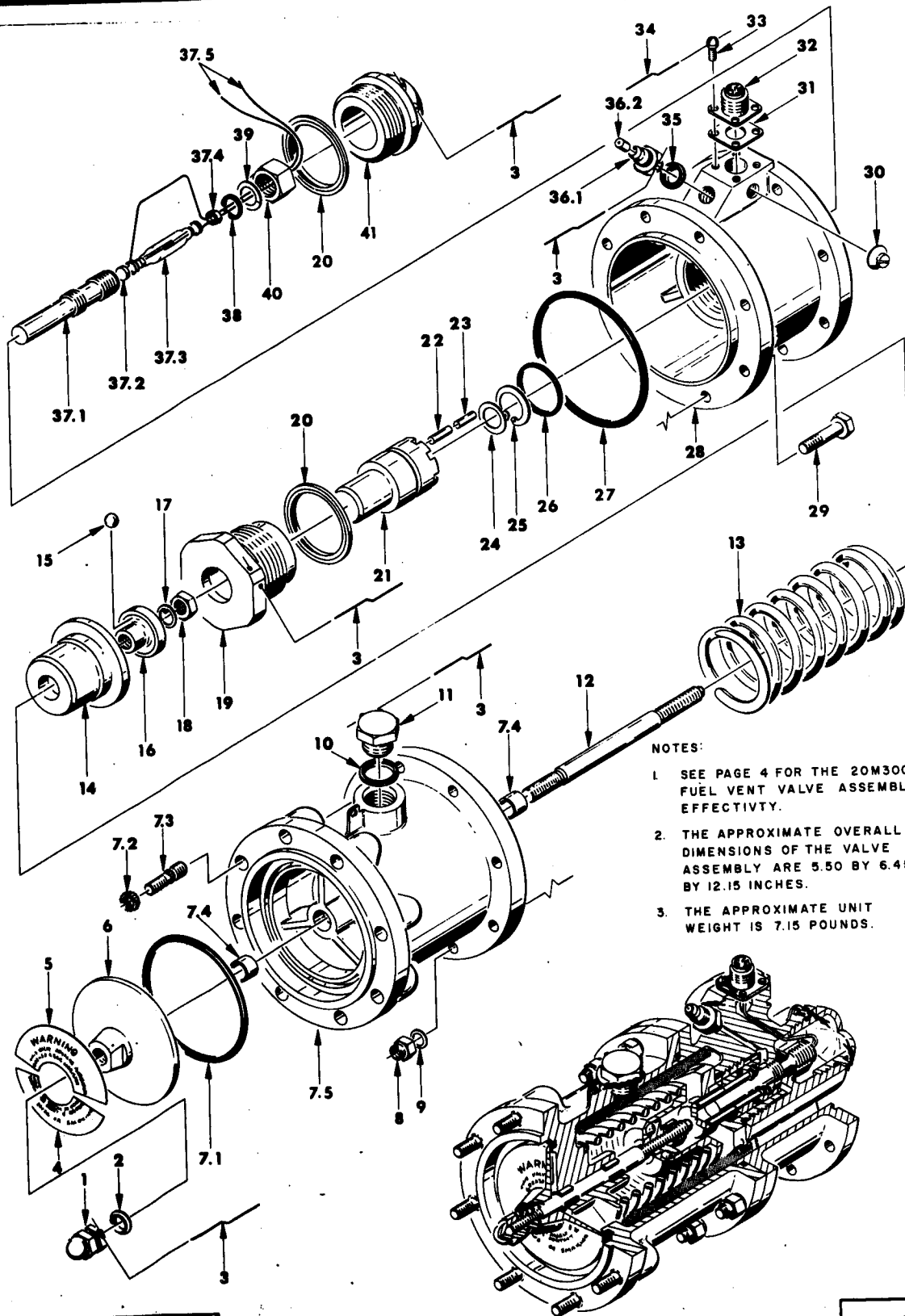
MPI-2000

PAGE

3

OF

4



NOTES:

1. SEE PAGE 4 FOR THE 20M30000 FUEL VENT VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 5.50 BY 6.45 BY 12.15 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 7.15 POUNDS.

REVISION DATE

M-ME-E-502

20M30000

1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms of 35 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

- 20 to 55 c.p.s. at three g's,
- 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
- 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve is outlined in Performance Specification 10M01068 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 MIL-Q-9858
 MIL-R-3065B
 MIL-W-16878
 NASA - MSFC-SPEC-164
 MSFC-PROC-158

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-643
 MS33540
 MS33586
 Army Ballistic Missile Agency
 ABMA-STD-18
 ABMA-STD-41

3.3 Drawings:

Ordnance Corps - 10414121
 10419909
 10509302
 10509303
 10509311
 10M01068

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	EO-1A, -2A, -3A, and -4A
SA-6	EO-1A, -2A, -3A, and -4A
SA-7	EO-1A, -2A, -3A, and -4A
SA-8	Not Applicable
SA-9	EO-1A, -2A, -3A, and -4A
SA-10	Not Applicable
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30000

MSFC - Form 1151-1 (June 1961)

REVISION DATE 28 June 1963

II.8.3

Page 11 of 11

SUMMARY SHEET	
Nomenclature Valve, LOX Vent	
Drawing Numbers: 10414001, 20M30122	Vendor: North American
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy	
Failure Rate: $17,452 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 35 Total Number of Failures Reported: 81	MCBF (in cycles): 57.3 Total Cycles of Operation: 4,638 Vehicle Equipment: X Ground Equipment:

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>5</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
<u>10</u>	Inoperative		Broken/Ruptured:
<u>34</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>2</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		_____
<u>2</u>	Would Not Close		
	Pressure:		
<u>1</u>	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-10 Vehicles (less flight data)			

II.8.4

DATA SHEET	
Nomenclature: Valve, LOX Vent	
Drawing Numbers: 10414001	Vendor: North American
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 16,286 x 10 ⁻⁶ /cy.	MCBF (in cycles): 61.4
Number of Components this Data Represents: 14	Total Cycles of Operation: 1,780
Number of Failures Reported: 29	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>140°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: Main seal 25 scim, shaft seal 20 scim at 150 psig	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: 22-55 cps at 5 g. 55-110 cps at 0.03 in. D.A.d. 110-2,000-cps at 20. g.	

December 1965

II.8.4

Page 3 of 18

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out	<u>2</u>	Indicator Shows:
<u>1</u>	Erratic		No Open
<u>19</u>	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>1</u>	Out of Specs		Other: <u>Failed to</u>
	Oil/Moisture Saturation		<u>close 2</u>
	Sticking		
	Would Not Open		
	Would Not Close		
	Pressure:		
<u>1</u>	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-1 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-62-5, Jan. 21, 1962, NASA/MSFC			

Additional information concerning the LOX Vent Valve component
10414001:

Twenty-two failures were reported on Inspection Reports,
and seven were reported on Unsatisfactory Condition Reports.

December 1965

II.8.4
Page 5 of 18

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 31 August 1961
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414001 LOX VENT VALVE ASSEMBLY		PROCEDURE EP-140
		APPROVED <i>R. Paul</i>
		PAGE 1 of 4

1. DESCRIPTION.

The LOX vent valve assembly 10414001 is a normally closed pneuma-mechanically operated gate type valve. The valve assembly is opened when the 10414000 LOX relief valve No. 1 fails to relieve sufficient GN₂ or GOX to prevent overpressurization of the LOX container. Therefore, when the LOX container pressure reaches 65 p.s.i.a. the LOX vent emergency switch assembly 10414341 calibrated by a three-way needle valve 10414087 supplies energy to the solenoid of the MV-74V control valve 10414027 that allows GN₂ from the control pressure system to pressurize the control port of the valve assembly. The valve assembly is used in the 7-inch vent assembly in the forward skirt of container L3 as shown in the installation view. The valve assembly is used in the 7-inch LOX vent valve and spacer assembly 10438146. The various functional characteristics of the valve assembly are as follows:

1.1 Mechanical Performance Characteristics. The valve assembly is capable of performing mechanically as follows:

- a. Operating line pressure: 65 p.s.i.a.
- b. Gate play: 1° maximum.
- c. Parallelism between the surface of the closed gate and the flat machined surface of valve housing: $\pm 0^\circ 30'$
- d. Service: GOX
- e. Nominal vent gate operating time, switch to switch:
To open - 150 milliseconds.
To close - 300 milliseconds.
- f. Internal leakage with 60 p.s.i.g. pressure in the line and the gate in both the open and closed positions alternately:
Shaft seals - 20 s.c.i.m. maximum.
Gate pin seals - 2 s.c.i.m. maximum.
Main seat - 25 s.c.i.m. maximum (applies only with gate in the closed position).
- g. Venting chamber operating temperature range: -150° to +165° F.

1.2 Pneumatic Operating Characteristics. The valve assembly is capable of operating pneumatically as follows:

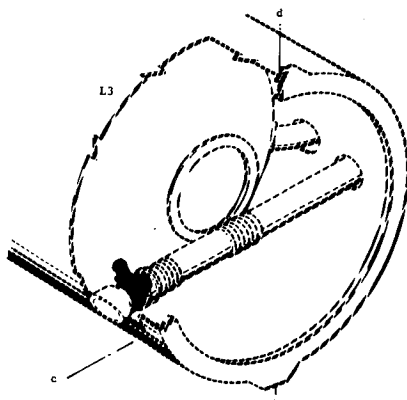
- a. Control cylinder operating temperature range: -65° to +165° F.
- b. Minimum operating pressure: 500 p.s.i.g. internal pneumatic pressure.
- c. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- d. Proof operating pressure: 1,125 p.s.i.g. internal pneumatic pressure.
- e. Burst pressure (without bursting): 1,875 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- f. Operating media: Air, gaseous nitrogen, or helium.
- g. Leakage past the control cylinder: 5 s.c.i.m. maximum with 750 p.s.i.g. internal pneumatic pressure applied.

1.3 Electrical Performance Requirements. The electrical performance requirements of the valve assembly are as follows:

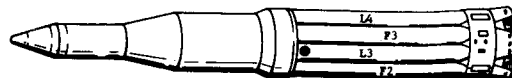
REVISION DATE

(Continued on page 4)

10414001



INSTALLATION VIEW - LOOKING AFT



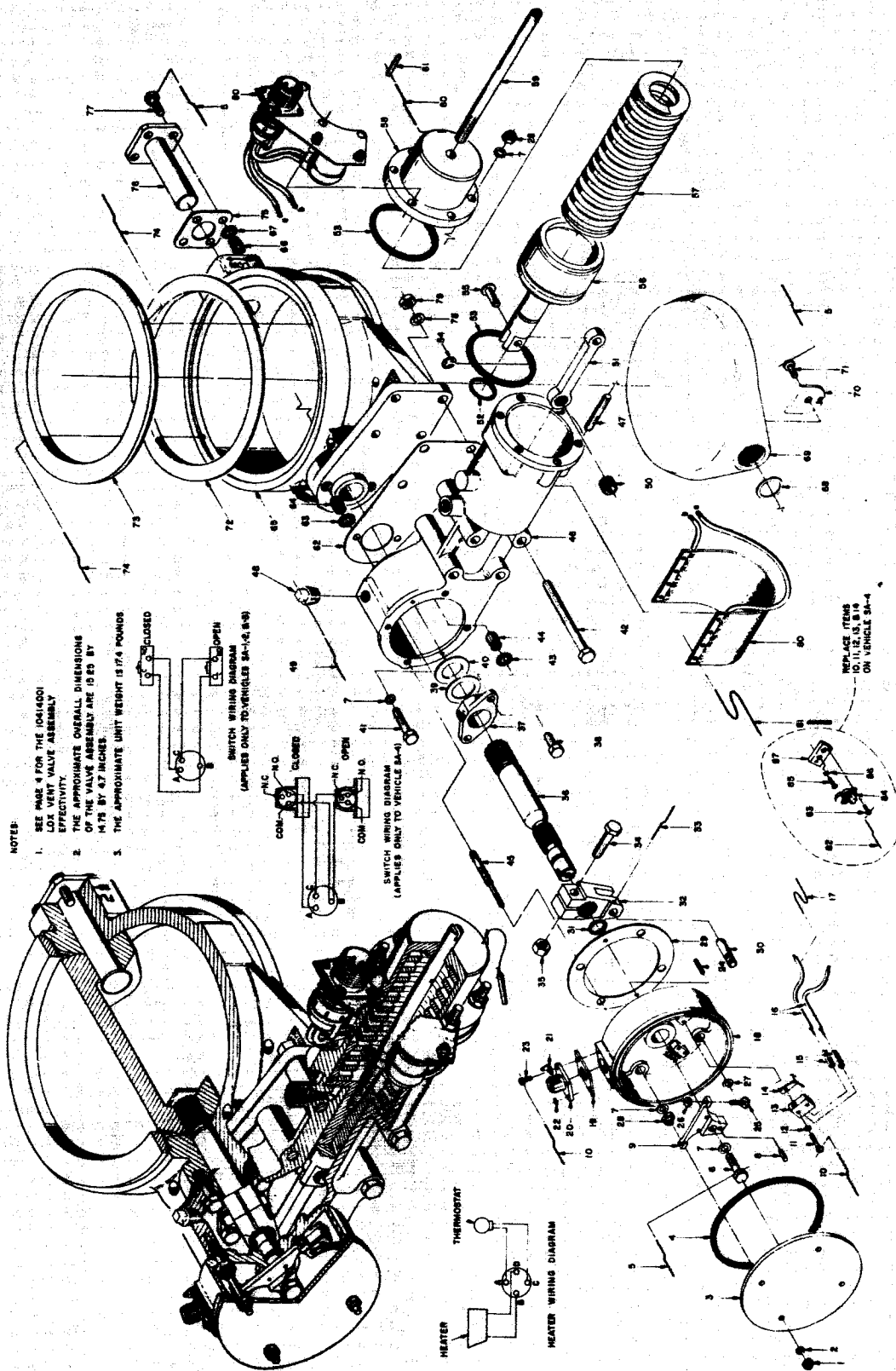
GENERAL LOCATION

LEGEND (CON.)

- NOTES**
- CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
 - ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.
 - IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH MSFC-STD-105.
 - CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
 - OR APPROVED EQUIVALENT.
 - TORQUE 16 TO 20 INCH-POUNDS.
 - LUBRICATE WITH DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.
 - LOCKWIRE IN ACCORDANCE WITH MS3540.
 - TORQUE 50 TO 70 INCH-POUNDS.
 - TORQUE 15 TO 18 INCH-POUNDS.
 - SPOT-TIE THE ELECTRICAL WIRES AT 3-INCH INTERVALS.
 - TORQUE 6 TO 8 INCH-POUNDS.
 - TORQUE 10 TO 12 INCH-POUNDS.
 - INSTALL UNDER THE NUT PLACED HERE AND ON THE OPPOSITE SIDE OF THE BOX. INSTALL WASHER 2W18-416 UNDER THE TWO REMAINING NUTS.
 - TORQUE 50 TO 70 INCH-POUNDS.
 - POSITION THIS LEVER SO THAT THE SPLINE INDEX SCRIBE MARK IS IN LINE WITH THE PUNCH MARK SHOWN ON THE SHAFT.
 - TORQUE 100 TO 140 INCH-POUNDS.
 - TORQUE TO 50 INCH-POUNDS.
 - PRIOR TO INSTALLING THE VALVE GATE AND SHAFT, PLACE THIS SEAL BLANK IN THE CASTING 9615-48013-9 AND RETAIN WITH THE RETAINER 9615-48024. WITH BOTH VALVES TOGETHER, FORCE THE TOOL 365-798 THROUGH THE SEAL BLANK TO PORN THE SEAL. REMOVE THE TOOL AND SEAL TOGETHER. INSTALL THE SHAFT AND SLIP THE FORMED SEAL FROM THE TOOL TO THE SHAFT BY USING THE RETAINER 9615-48024.
- LEGEND**
- 10414001
- MS4679A08W
 - 800-015-8
 - 9512-48065
 - AN6230B22
 - MS20995M40
 - AN4810A
 - 2W18-416
 - 9512-48425
 - 2P9-7-7
 - 9512-48425-3
 - 9512-48429
 - AN995M20
 - AN500A2-10
 - 2W1C6-8-16
 - 2586
 - JE-1
 -
 -
- LOX VALVE ASSEMBLY ("D" REV. & EO-7 & -8 ON SA-1, -2, & -3) "E" REV. & EO-9 ON SA-4 ONLY) (NORTH AMERICAN AVIATION INC. NO. 9512-48410-61)
- NUT (4 PLACES) (P)
- LOCK-O-SEAL (4 PLACES) (P)
- COVER (P)
- PREFORMED PACKING (O-RING) (P)
- LOCKWIRE (P)
- BOLT (P)
- WASHER (P)
- VALVE SWITCH ARM ASSEMBLY (P)
- PIN ARM (P)
- SWITCH ASSEMBLY (P)
- LOCKWIRE (P)
- SCREW (4 PLACES) (P)
- WASHER (4 PLACES) (P)
- MICRO SWITCH (MICRO SWITCH CORP.) (2 PLACES) (P)
- ACTUATOR (MICRO SWITCH CORP.) (2 PLACES) (P)
- INSULATION TUBING (P)
- ELECTRICAL WIRING (P)

- TYING CORD (M)
- BOX
- GASKET (BENDIX AVIATION CORP.) (P)
- CONNECTOR (REPLACES THE VENDOR FURNISHED AN3102E10SL3P CONNECTOR)
- LUG (REPLACES PART NO. R2-1-1) (P)
- WASHER (3 PLACES) (P)
- SCREW (4 PLACES) (P)
- PIN
- SETSCREW (2 PLACES) (P)
- NUT (2 PLACES) (P)
- WASHER (2 PLACES) (P)
- NUT (P)
- GASKET
- PIN (P)
- PREFORMED PACKING (O-RING) (P)
- LEVER (P)
- LOCKWIRE (P)
- BOLT (P)
- NUT (P)
- SHAFT
- RETAINER
- BOLT (2 PLACES) (P)
- WASHER
- SEAL (P)
- BOLT (2 PLACES) (P)
- BOLT (4 PLACES) (P)
- PISTON HOUSING ASSEMBLY
- RING (2 PLACES) (P)
- INSERT (2 PLACES) (P)
- STUD (4 PLACES) (P)
- CASTING
- STUD (6 PLACES) (P)
- SQUARE HEAD PIPE THREAD PLUG (REPLACES THE VENDOR FURNISHED AN816-4C NIPPLE) (P)
- LOCKWIRE (P)
- BUSHING (P)
- LINK (P)
- PREFORMED PACKING (O-RING) (P)
- PREFORMED PACKING (O-RING) (P)
- PIN (VALDES KOHNOR INC.) (P)
- PISTON ASSEMBLY (P)
- SPRING (P)
- CYLINDER CAP
- BOLT (P)
- LOCKWIRE (P)
- TAPER PIN (MAKE FROM MS24692-155D) (REPLACES THE VENDOR FURNISHED PIN AN385AN10P7)
- GASKET
- HOUSING ASSEMBLY
- RING (2 PLACES) (P)
- INSERT (2 PLACES) (P)
- HOUSING
- INSERT (4 PLACES) (P)
- RING (4 PLACES) (P)
- WASHER
- GATE
- WASHER
- BOLT (P)
- LIPSEAL (REPLACES THE VENDOR FURNISHED 9615-48107 SEAL) (P)
- RING
- LOCKWIRE (P)
- GASKET
- PIN (P)
- BOLT (4 PLACES) (P)
- WASHER (4 PLACES) (P)
- NUT (4 PLACES) (P)
- HEATER ASSEMBLY (REMOVE THE AN3100E16-9P CONNECTOR AND REPLACE WITH MS3100E16-9P)
- BRASS WIRE (MIL-C-4-321, COMP. A) (P)
- LOCKWIRE (P)
- RIGHT HAND SWITCH ASSEMBLY - SHOWN; LEFT HAND SWITCH ASSEMBLY 20N00426 - OPPOSITE (USED TO REPLACE THE VENDOR FURNISHED SWITCHES AND ATTACHING HARDWARE) (P)
- SCREW (4 PLACES) (P)
- RIGHT HAND SPOT SWITCH (BO-1) (TEXAS INSTRUMENT INC. AT25-1) SHOWN; LEFT HAND SPOT SWITCH 20N00335, BO-1 (TEXAS INSTRUMENT INC. AT25-2) - OPPOSITE (P)
- FLAT HEAD SCREW (4 PLACES) (P)
- CONICAL LOCK WASHER (4 PLACES) (P)
- SWITCH MOUNTING PLATE (SH SHOWN); SWITCH MOUNTING PLATE 20N00471-1 (LM OPPOSITE) (REPLACES THE VENDOR FURNISHED MOUNTING PLATE) (P)

DRAWN BY:	<i>J. B. Bots</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414001	REVISION DATE OF THIS PAGE
PLANNER:	<i>John E. Bannett</i>	D or E	EO'S	-7 & -8 or -9	26 Oct 1962
WRITER:	<i>C. J. Schunk</i>		ART CONTROL NO.	M-MS-EP140- 464-D	
APPROVED BY:	<i>R. R. Hightower</i>				



REVISION DATE 14 SEP. 1962

10414001

- a. Switch actuation: At $1^\circ \pm 0^\circ 30'$ before the gate is in it completely open or closed position, for vehicles SA-1, -2 and -3. At $2^\circ \pm 1^\circ$ before the gate is in its completely open or closed position, for vehicle SA-4.
- b. The heater and switch wiring diagrams are shown on page 3.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for five minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at three g's,
55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10419910 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106
MSFC-SPEC-164
Rocketdyne - RA0113-001

3.3 Drawings:

Ordnance Corps - 10509302, 10509303
MSFC - 10419909, 10419910

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile
Agency - ABMA-STD-18
NASA - MSFC-STD-105

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"D" Rev. and EO-7 & -8
SA-1	"D" Rev. and EO-7 & -8
SA-2	"D" Rev. and EO-7 & -8
SA-3	"D" Rev. and EO-7 & -8
SA-4	"E" Rev. and EO-9
SPARES	Before installing modify to latest configuration

10414001

REVISION DATE 26 OCT 1962

DATA SHEET	
Nomenclature: Valve, LOX Vent	
Drawing Numbers: 20M30122	Vendor: North American
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 18,182 x 10 ⁻⁶ /cy.	MCBF (in cycles): 55
Number of Components this Data Represents: 21	Total Cycles of Operation: 2,858*
Number of Failures Reported: 52	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature: -250°F	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop): 35 g sawtooth wave form; long: 3.7 M sec.; B axis: 3.0 M Sec.; A axis: 4.2 M sec.	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: (See page 13)	

December 1965

* Minimum operating cycle data; serial nos. Co 32, CH66 were not included on time and cycle log.

II.8.4

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic	<u>2</u>	No Open
	Foreign Material	<u>11</u>	No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
<u>4</u>	Inoperative		Broken/Ruptured:
<u>17</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish	<u>6</u>	Other: <u>1 valve had</u> <u>to be cycled 5 times</u> <u>before indicator</u> <u>showed that the</u> <u>valve was closed</u>
<u>3</u>	Out of Specs		
	Oil/Moisture Saturation		
<u>5</u>	Sticking		
	Would Not Open		
<u>3</u>	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Chrysler ME-M199-S182, December 27, 1963			

Additional information concerning the LOX Vent Valve 20M30122 component:

Forty-three failures were reported on Inspection Reports, nine were reported on Unsatisfactory Condition Reports.

Vibration Qualification test:

Sweep:

20-37 cps at 0.2" D.A.

37-300 cps at 14.0 g

300-510 cps at 0.003" D.A.

510-2,000 cps at 40.0 g
10 minutes, all 3 axes

Resonance:

20-37 cps at 0.1" D.A.

37-300 cps at 7.0 g

300-510 cps at 0.0015" D.A.

510-2,000 cps at 20.0 g

5 min. each major resonant point in all 3 axes.

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MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE NO.
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30122 LOX VENT VALVE ASSEMBLY				15 December 1961	MP1-2000
				APPROVED <i>A. Paul</i>	PAGE 1 OF 4

1. DESCRIPTION.

The LOX vent valve assembly 20M30122 is a normally closed pneuma-mechanically operated gate type valve. The valve assembly is opened when the 20M30121 LOX relief valve No. 2 fails to relieve sufficient GN₂ or GOX to prevent overpressurization of the LOX container. Therefore, when the LOX container pressure reaches 65 p.s.i.a. the LOX vent emergency switch assembly 20M30186 calibrated by a three-way needle valve 10414087 supplies energy to the solenoid of the valve and orifice assembly 20M30172 that allows GN₂ from the control pressure system to pressurize the control port of the valve assembly. The valve assembly is used in the 7-inch vent assembly in the forward skirt of container L1 as shown in the installation view. The valve assembly is used in the 7-inch LOX vent valve and spacer assembly 20M00873. The various functional characteristics of the valve assembly are as follows:

1.1 Mechanical Performance Characteristics. The valve assembly is capable of performing mechanically as follows:

- a. Operating line pressure: 150 p.s.i.g.
- b. Proof operating line pressure: 225 p.s.i.g.
- c. Burst line pressure (without bursting): 375 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
- d. Gate play: 1° maximum.
- e. Parallelism between the surface of the closed gate and the flat machined surface of valve housing: $\pm 0^\circ 30'$
- f. Service: GOX
- g. Nominal vent gate operating time, switch to switch:
 To open - 75 milliseconds.
 To close - 200 milliseconds.
- h. Internal leakage with 60 p.s.i.g. pressure in the line and the gate in both the open and closed positions alternately:
 Shaft seals - 20 s.c.i.m. maximum.
 Gate pin seals - 2 s.c.i.m. maximum.
 Main seat - 25 s.c.i.m. maximum (applies only with gate in the closed position).
- i. Venting chamber operating temperature range: -250° to +250° F.

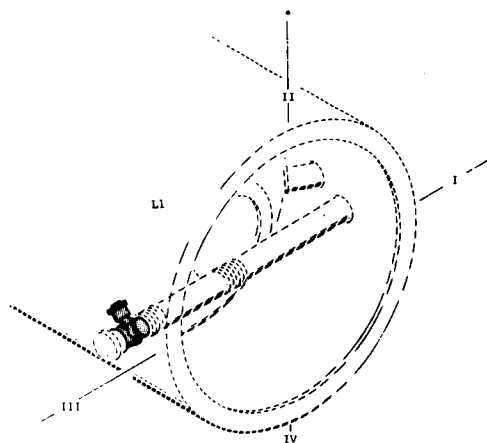
1.2 Pneumatic Operating Characteristics. The valve assembly is capable of operating pneumatically as follows:

- a. Control cylinder operating temperature range: -250° to +250° F.
- b. Minimum operating pressure: 300 p.s.i.g. internal pneumatic pressure.
- c. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- d. Proof operating pressure: 1,125 p.s.i.g. internal pneumatic pressure.
- e. Burst pressure (without bursting): 1,875 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- f. Operating media: Air, gaseous nitrogen, or helium.
- g. Leakage past the control cylinder: 1 s.c.i.m. maximum with 750 p.s.i.g. internal pneumatic pressure applied.

1.3 Electrical Performance Requirements. The electrical performance requirements of the valve assembly are as follows:

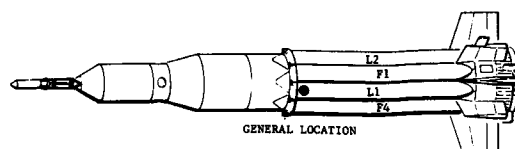
(Continued on page 4)

20M30122



INSTALLATION VIEW - LOOKING AFT

- NOTES**
- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-106.
 - (B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.
 - (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - (D) STAMP THE CURIE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509111.
 - (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
 - (F) OR APPROVED EQUIVALENT.
 - (G) TORQUE 16 TO 20 INCH-POUNDS.
 - (H) LUBRICATE WITH DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.
 - (I) LOCKWIRE IN ACCORDANCE WITH MSJ3540.
 - (J) TORQUE 50 TO 70 INCH-POUNDS.
 - (K) TORQUE 15 TO 18 INCH-POUNDS.
 - (L) SPOT-TIE THE ELECTRICAL WIRES AT 3-INCH INTERVALS.
 - (M) TORQUE 6 TO 8 INCH-POUNDS.
 - (N) TORQUE 10 TO 12 INCH-POUNDS.
 - (O) INSTALL UNDER THE NUT PLACED HERE AND ON THE OPPOSITE SIDE OF THE BOX. INSTALL WASHER 2W18-416 UNDER THE TWO REMAINING NUTS.
 - (P) TORQUE 50 TO 70 INCH-POUNDS.
 - (Q) POSITION THIS LEVER SO THAT THE SPLINE INDEX SCRIBE MARK IS IN LINE WITH THE PUNCH MARK SHOWN ON THE SHAFT.
 - (R) TORQUE 100 TO 140 INCH-POUNDS.
 - (S) TORQUE TO 50 INCH-POUNDS.
 - (T) PRIOR TO INSTALLING THE VALVE GATE AND SHAFT, PLACE THIS SEAL BLANK IN THE CASTING 9615-48013-9 AND RETAIN WITH THE RETAINER 9615-48024. WITH BOTH HALVES TOGETHER, FORCE THE TOOL 365-798 THROUGH THE SEAL BLANK TO FORM THE SEAL. REMOVE THE TOOL AND SEAL TOGETHER. INSTALL THE SHAFT AND SLIP THE FORMED SEAL FROM THE TOOL TO THE SHAFT BY USING THE RETAINER 9615-48024.
 - (U) LUBRICATE WITH ALPHA MOLYKOTE CORP. MOLYKOTE TYPE 2 POWDER OR APPROVED EQUIVALENT. BLOW OFF EXCESS LUBRICANT WITH DRY NITROGEN GAS.
- LEGEND**
- | | |
|------------------|---|
| 20M30122 | LOX VALVE ASSEMBLY ("A" REV.) (NORTH AMERICAN AVIATION INC. NO. 9512-48410-61) |
| 1. WAS679A08W | NUT (4 PLACES) |
| 2. 800-015-8 | LOCK-O-SEAL (4 PLACES) |
| 3. 9512-48065 | COVER |
| 4. AN6230822 | PREFORMED PACKING (O-RING) |
| 5. MS20995N40 | LOCKWIRE |
| 6. AN4H10A | BOLT |
| 7. 2W18-416 | WASHER |
| 8. 9512-48425 | VALVE SWITCH ARM ASSEMBLY |
| 8.1 2P9-7-7 | PIN |
| 8.2 9512-48425-3 | ARM |
| 9. 9512-48429 | SWITCH ASSEMBLY |
| 9.1 MS20995C20 | LOCKWIRE |
| 9.2 20M30427 | RIGHT HAND SWITCH ASSEMBLY - SHOWN; LEFT HAND SWITCH ASSEMBLY 20M30426 - OPPOSITE (REPLACES THE VENDOR FURNISHED SWITCHES AND ATTACHING HARDWARE) |



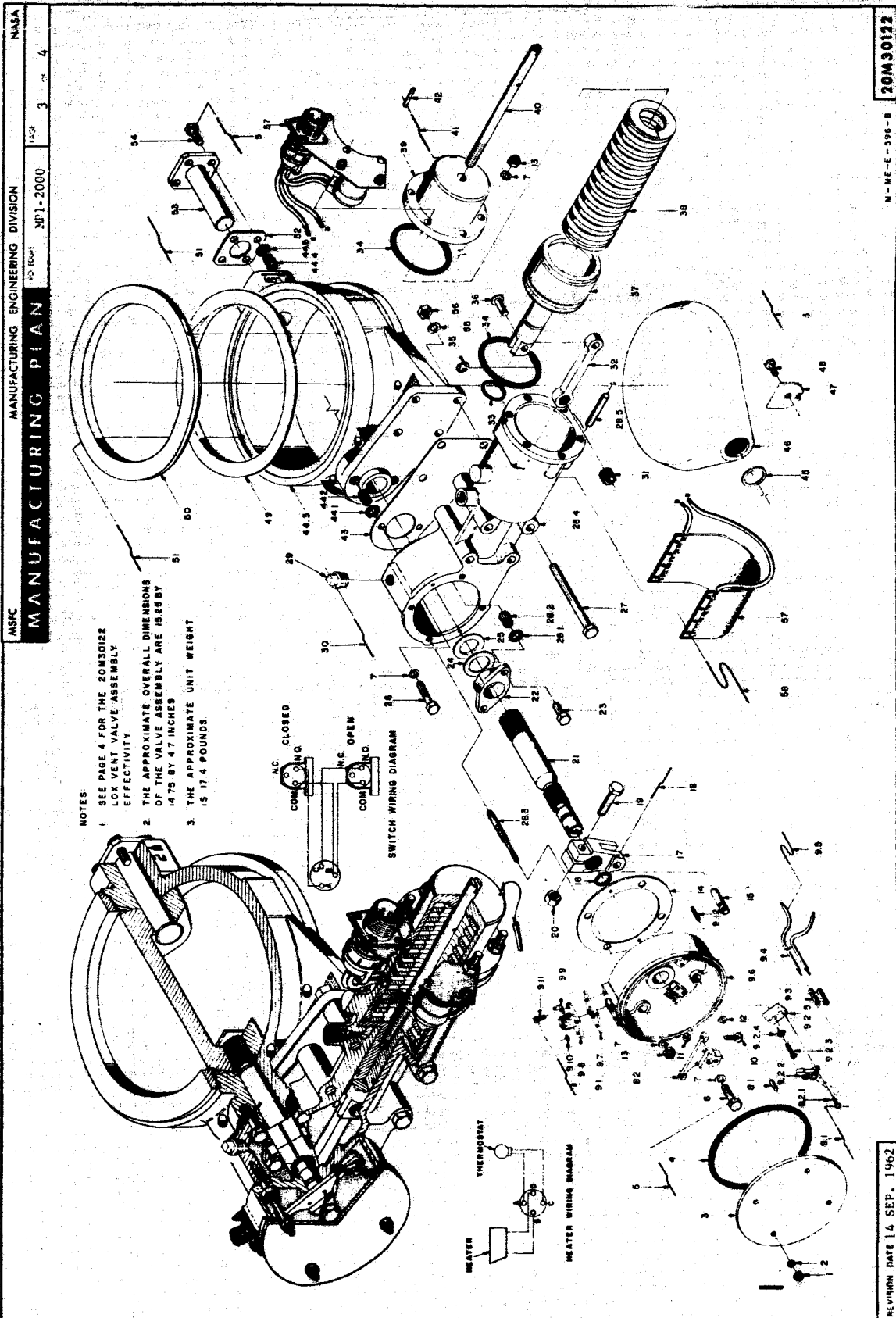
GENERAL LOCATION

LEGEND (CON.)

- | | | |
|-------|-----------------|--|
| 9.2.2 | 20M30336 | RIGHT HAND SPDT SWITCH (EO-2) (TEXAS INSTRUMENT INC. AT25-1) - SHOWN; LEFT HAND SPDT SWITCH 20M30335, EO-2 (TEXAS INSTRUMENT INC. AT25-2) - OPPOSITE |
| 9.2.3 | #2-56NC-0.437 | FLAT HEAD SCREW (4 PLACES) |
| 9.2.4 | | CONICAL LOCK WASHER (4 PLACES) |
| 9.2.5 | 20M30471-2 | SWITCH MOUNTING PLATE (RH SHOWN); SWITCH MOUNTING PLATE 20M30471-1 (LH OPPOSITE) (REPLACES THE VENDOR FURNISHED MOUNTING PLATE) |
| 9.3 | | INSULATION TUBING |
| 9.4 | | ELECTRICAL WIRING (MIL-W-16878 TYPE EE-20) |
| 9.5 | 9615-48066 | TYING CORD |
| 9.6 | | BOX |
| 9.7 | 10-40450-10 | GASKET (BENDIX AVIATION CORP.) |
| 9.8 | MS3102E10SL3P | CONNECTOR (REPLACES THE VENDOR FURNISHED AN3102E10SL3P CONNECTOR) |
| 9.9 | RD191-4002-0001 | LUC (REPLACES PART NO. R2-1-1) |
| 9.10 | 2W18-4 | WASHER (3 PLACES) |
| 9.11 | AN500A4-6 | SCREW (4 PLACES) |
| 9.12 | AN122676 | PIN |
| 10. | 9612-48422 | SETSCREW (2 PLACES) |
| 11. | AN340-6 | NUT (2 PLACES) |
| 12. | 2W18-4 | WASHER (2 PLACES) |
| 13. | MS679A08W | NUT |
| 14. | 9615-48030 | GASKET |
| 15. | 9615-48427 | PIN |
| 16. | AN622789 | PREFORMED PACKING (O-RING) |
| 17. | 9512-48426 | LEVER |
| 18. | MS20995N51 | LOCKWIRE |
| 19. | AN5-12A | BOLT |
| 20. | MS679A5 | NUT |
| 21. | 9512-48431 | SHAFT |
| 22. | 9615-48024 | RETAINER |
| 23. | AN4-5A | BOLT (2 PLACES) |
| 24. | 9615-48269 | WASHER |
| 25. | 9512-48062 | SEAL |
| 26. | AN4-11A | BOLT (2 PLACES) |
| 27. | AN3-32A | BOLT (4 PLACES) |
| 28. | 9615-48013-51 | PISTON HOUSING ASSEMBLY |
| 28.1 | KN-6-1 | RING (2 PLACES) |
| 28.2 | L1246-1-6 | INSERT (2 PLACES) |
| 28.3 | 9615-48068 | STUD (4 PLACES) |
| 28.4 | 9615-48013-9 | CASTING |
| 28.5 | 4004-96 | STUD (6 PLACES) |
| 29. | MS20913-1D | SQUARE HEAD PIPE THREAD PLUG (REPLACES THE VENDOR FURNISHED AN816-4C NUTPLUG) |
| 30. | MS20995C32 | LOCKWIRE |
| 31. | 9615-48266 | BUSHING |
| 32. | 9512-48432 | LINK |
| 33. | AN6227813 | PREFORMED PACKING (O-RING) |
| 34. | AN623086 | PREFORMED PACKING (O-RING) |
| 35. | X5133-31MW | RING (WALDES KOHINOOR INC.) |
| 36. | 9512-48014 | PIN |
| 37. | 402658 | PISTON ASSEMBLY |
| 38. | 9-3226-11 | SPRING |
| 39. | 402656 | CYLINDER CAP |
| 40. | 402657 | BOLT |
| 41. | MS20995N32 | LOCKWIRE |
| 42. | 20M30482 | PIN (MAKE FROM MS24692-155D) (REPLACES THE VENDOR FURNISHED PIN AN385A10P7) |
| 43. | 9627-48497 | GASKET |
| 44. | 9512-48411 | HOUSING ASSEMBLY |
| 44.1 | RL2858-8 | RING (2 PLACES) |
| 44.2 | RD20658-6-5L | INSERT (2 PLACES) |
| 44.3 | 9512-48411 | HOUSING |
| 44.4 | R20658-8 | INSERT (4 PLACES) |
| 44.5 | RL2858-8 | RING (4 PLACES) |
| 45. | 9512-48424 | WASHER |
| 46. | 9615-48591-3 | GATE |
| 47. | 9615-48074-3 | WASHER |
| 48. | AN3H3A | BOLT |
| 49. | 20M30285 | LIPSEAL (REPLACES THE VENDOR FURNISHED 9615-48107 SEAL) |
| 50. | 9512-48413 | RING |
| 51. | MS20995N91 | LOCKWIRE |
| 52. | 9512-48360 | GASKET |
| 53. | 9615-48020 | PIN |
| 54. | AN4H5A | BOLT (4 PLACES) |
| 55. | 2W18-516 | WASHER (4 PLACES) |
| 56. | MS679A5 | NUT (4 PLACES) |
| 57. | 9512-48430 | HEATER ASSEMBLY (REMOVE THE AN3100E16-9P CONNECTOR AND REPLACE WITH MS3100E16-9P) |
| 58. | | BRASS WIRE (MIL-QQ-W-321, COMP. A) |

DRAWN BY:	J. Bette	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30122	REVISION DATE OF THIS PAGE
PLANNER:	W. B. Bennett		EO's	
WRITER:	B. P. Crawley	A		
APPROVED BY:	M. J. K. K. K.		ART CONTROL NO. M-ME-E-596-C	14 Sep.1962

MSFC - Form 1151-1 (June 1961)



- a. Switch actuation: At $1^{\circ} + 0^{\circ}$ or $-30'$ before the gate is in its completely open position. At $2^{\circ} + 1^{\circ}$ or -0° before the gate is in its completely closed position.
- b. The heater and switch wiring diagrams are shown on page 3.
- c. Heater operating range: Energize, 70° F minimum. Deenergize, 145° F. maximum.
- d. Insulation resistance: 50 megohms between each terminal and the valve body.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:
 - 10-milliseconds duration - triangular wave, or
 - 8-milliseconds duration - sine wave, or
 - 6-milliseconds duration - square wave.
- 1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for five minutes duration in each of the three major axes under the following conditions:
 - 20 to 55 c.p.s. at three g's,
 - 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 - 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10M01154 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106
 MSFC-SPEC-164
 MSFC-PROC-158
 Rocketdyne - RA0113-001
 RB0140-005

3.2 Standards:

Military - MIL-STD-130
 MS33540
 Army Ballistic Missile
 Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10419909
 10509302
 10509303
 10509311
 10M01154 EFFECTIVITY

VEHICLE	REVISIONS
SA-5	"A" Rev.
SA-6	"A" Rev.
SA-7	"A" Rev.
SA-8	"A" Rev.
SA-9	"A" Rev.
SA-10	"A" Rev.
Spares	Before installing modify to latest configuration

20M30122

SIGN DATE 20 JUL 1962

DATA SHEET	
Nomenclature: Valve (shutoff)	
Drawing Numbers: 10417001	Vendor: Gulton Industries Hydromatics Inc.
Saturn I Vehicle	Location: Instrument Unit
Estimated Design Life: 5,000 cy.	
Failure Rate: 14,598 x 10 ⁻⁶ /cy.	MCBF (in cycles): 68.5
Number of Components this Data Represents: 9	Total Cycles of Operation: 411
Number of Failures Reported: 6	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: 125°F	
Low Temperature: -320°F	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop): 6 shocks (square wave) at 20 g for 10 milliseconds.	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: 20-50 cps at 2 g, 50-110 cps at 0.016 in. D.A.D. 110-2,000 cps at 10 g	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>2</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>4</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		_____
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report IN-P&VE-62-5, January 21, 1962.			

Additional information concerning the 10417001 valve:

All six failures were reported on Inspection Reports.

(Intentionally Left Blank)

MSPC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10417001 1/2-INCH MODULATING SHUTOFF VALVE				2 June 1962	EP-140
				APPROVED	PAGE
				1	of 4

1. DESCRIPTION.

The 1/2-inch modulating shutoff valve 10417001 is an electrically operated valve and is a component of the instrument containers cooling system located in instrument containers 12 and 15 as applicable. The valve is used to supply the required amount of gaseous nitrogen to the ST-90 and ST-124 stabilized platform compartments, and is controlled by an electrical bridge circuit system made up of a control box and two thermistor temperature sensors. Microswitches signal the valve to close when the compartment covers are opened or removed. The shutoff valve is installed in instrument container 15 on vehicles SA-1 and -2 and instrument containers 12 and 15 on vehicles SA-3 and -4 as shown in the installation view. The various functional characteristics of the shutoff valve are as follows:

1.1 Mechanical Performance Characteristics. The shutoff valve is capable of performing mechanically as follows:

- Operating media: Gaseous nitrogen
- Nominal operating pressure: 30 p.s.i.g.
- Proof pressure: 45 p.s.i.g.
- Burst pressure (without bursting): 120 p.s.i.g. minimum (CAUTION: Use only for destructive acceptance testing.)
- Operating temperature range: -320° to +125° F.
- Storage temperature: -80° to +165° F.
- Actuation time: The shutoff valve is capable of traversing from the fully open to the fully closed position in 10 to 12 seconds with an actuator voltage of 28 v.d.c.
- External leakage (valve fully closed): 5 s.c.i.m. maximum when pressurized to 45 p.s.i.g. at -280° to +40° F. in direction of flow for 5 minutes.

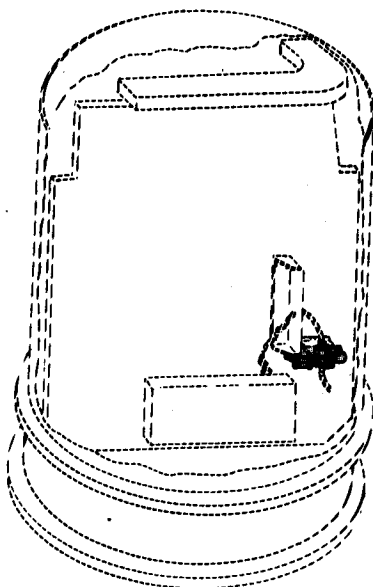
1.2 Electrical Performance Characteristics. The shutoff valve is capable of performing electrically as follows:

- Nominal operating voltage: 18 to 30 v.d.c.
- Maximum operating current of actuator: 2 a. at 27 v.d.c.
- Insulation resistance: 50 megohms minimum with 500 v.d.c. applied between each pin and the valve housing.
- Potentiometer resistance: Valve open - 5,540 \pm 50 ohms between pins "A" and "B", valve closed - maximum 50 ohms between pins "A" and "B".
- Potentiometer resolution: 27 ohms minimum.
- Potentiometer overshoot: 134.5 ohms maximum.
- The wiring diagrams are shown on page 3.

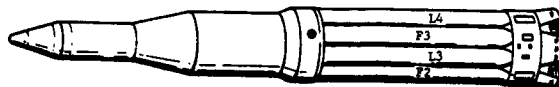
1.3 Life Cycle. The shutoff valve is capable of completing 5,000 cycles minimum with an internal temperature of -300° to +20° F. without damage or impairment of performance.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

(Continued on page 4)



INSTALLATION VIEW - TYPICAL ON INSTRUMENT
CONTAINERS 12 & 15 (CONTAINER 12 IS APPLICABLE
ONLY TO VEHICLES SA-3 & -4)



GENERAL LOCATION

—NOTES—

- (A) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (B) STAMP THE CURT DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (C) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (D) OR APPROVED EQUIVALENT.
- (E) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (F) LUBRICATE O-RINGS WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE Z OR APPROVED EQUIVALENT

—LEGEND—

10417001 1/2-INCH MODULATING SHUT-OFF VALVE
(“A” REV.) (HYDROMATICS, INC., 121C3)

(A) (B) (C) (D) (E) (F)

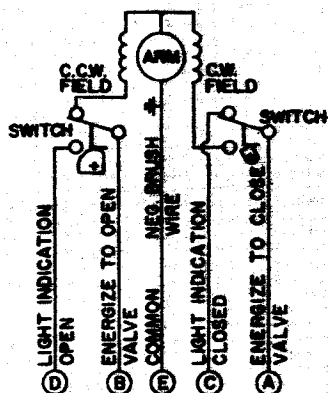
DRAWN BY:	<i>B. Dennis</i>	ENGINEERING DRAWING RELEASE A	REVISION TO: 10417001	REVISION DATE OF THIS PAGE
PLANNER:	<i>W. E. Bennett</i>		80'S	
VIEWER:	<i>W. W. Franklin</i>			
APPROVED BY:	<i>W. W. Franklin</i>		ART CONTROL NO. M-ME-EP140-752	

MSFC - Form 1181-1 (June 1964)

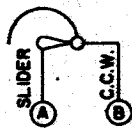
MANUFACTURING PLAN

PROCEDURE EP-140

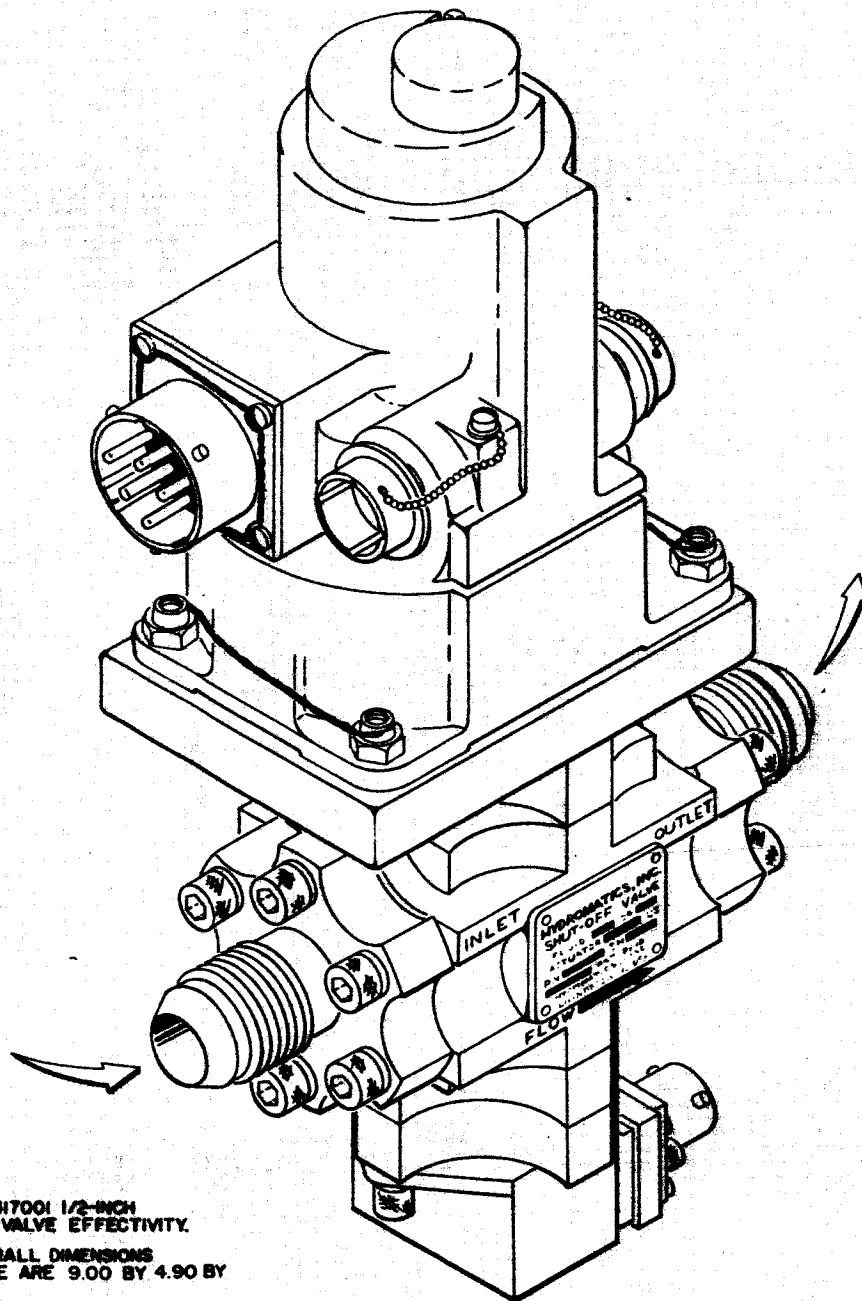
PAGE 3 of 4



MOTOR ACTUATOR WIRING
SCHEMATIC - VALVE IN
CLOSED POSITION



POTENTIOMETER WIRING
SCHEMATIC - VALVE IN
CLOSED POSITION



NOTES:

1. SEE PAGE 4 FOR THE 10417001 1/2-INCH MODULATING SHUT-OFF VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE SHUT-OFF VALVE ARE 9.00 BY 4.90 BY 3.16 INCHES.
3. THE APPROXIMATE OVERALL WEIGHT IS 4.40 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

REVISION DATE

M-MS-EP140-728

10417001

1.4 Shock Withstanding Capability. The shutoff valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 20 g's in each of the three major axes.

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.5 Vibration Withstanding Capability. The shutoff valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 10 minutes duration in each of the three major axes under the following conditions:

- 20 to 45 c.p.s. at one g,
- 45 to 95 c.p.s. at 0.01-inch double amplitude displacement, and
- 95 to 2,000 c.p.s. at 5 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance test and the preparation for delivery of the shutoff valve are outlined in Qualification Test Specification 10481646, Acceptance Test Requirements 10417201, and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33586
Army Ballistic Missile Agency -
ABMA-STD-29

3.3 Drawings:

Ordnance Corps - 10417201
10481643
10481646
10509300
10509302
10509305
10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	Not Applicable
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev.
SPARES	Before installing modify to latest configuration

10417001

REVISION DATE

DATA SHEET	
Nomenclature: Valve (shutoff)	
Drawing Numbers: 10481705 Saturn I Vehicle	Vendor: Hydromatics Inc. Location: Umbilical Cord System
Estimated Design Life: 5,000 cy.	
Failure Rate: 3,696 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 12 Number of Failures Reported: 4	MCBF (in cycles): 270.5 Total Cycles of Operation: 1,082 Vehicle Equipment: Ground Equipment: X
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish	<u>1</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>1</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 10481705 valve:

All four failures were reported on Inspection Reports

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10481705 PNEUMATIC 1-INCH SHUTOFF VALVE				19 February 1962	EP-140
				APPROVED <i>P. Rust</i>	PAGE 1 OF 4

1. DESCRIPTION.

The pneumatic 1-inch shutoff valve 10481705 is a component of the external cooling system. The valve is used to vent liquid nitrogen from the LN₂ cooler and dehumidifier of the ground LN₂ cooler. The valve is installed on the external cooling package bracket assembly 10481718 in the external cooling package mounted atop the long cable mast as shown in the installation view. The various functional characteristics of the valve are as follows:

1.1 Pneumatic Operating Characteristics. The valve is capable of operating pneumatically as follows:

- Operating medium: Liquid nitrogen.
- Nominal operating pressure: 30 p.s.i.g.
- Proof operating pressure: 45 p.s.i.g.
- Burst pressure (without bursting): 90 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
- Actuating control pressure: 750 p.s.i.g. (to open or to close).
- Leakage through actuator: 5 s.c.i.m. maximum.
- Operating temperature range: -320° to +125°F.
- Storage temperature range: -80° to +160°F.
- Venting flow capacity: 160 s.c.i.m. (12 pounds per minute) minimum at 30 p.s.i.g. and -280° ± 40°F with valve fully open.

1.2 Electrical Performance Characteristics. The valve is capable of performing electrically as follows:

- Operating voltage: 18 to 30 v.d.c.
- Operating current: 15 a. maximum inrush.
- Inductive current: 3 a.
- Resistive current: 4 a.
- The switch wiring diagram is shown on page 3.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the shutoff valve are outlined in Acceptance Test Requirements 10481709 and Packaging and Packing Specification 10509302.

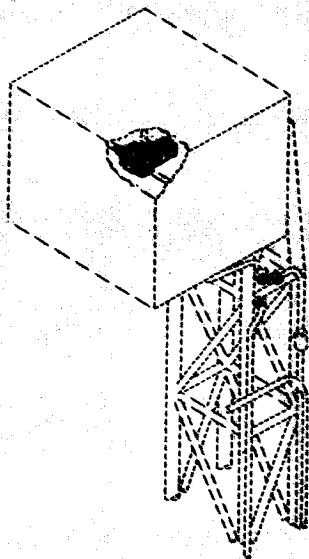
3. REFERENCES.

3.1 <u>Specifications:</u> Military - MIL-E-5272	3.2 <u>Standards:</u> Military - MIL-STD-130 Army Ballistic Missile Agency ABMA-STD-18
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(Continued on page 4)

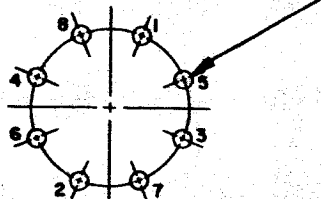
REVISION DATE II.9.2 Page 4 of 7	10481705
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MSFC - Form 1151 (June 1961)



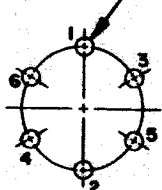
INSTALLATION VIEW - LONG CABLE MAST

TIGHTEN SCREWS IN THE ORDER SHOWN TO 35 IN.-LBS. THEN REPEAT TO 45 IN.-LBS.



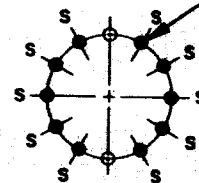
DETAIL A - TYPICAL SCREW PATTERN FOR ITEM 3.

TIGHTEN SCREWS IN THE ORDER SHOWN TO 35 IN.-LBS. THEN REPEAT TO 45 IN.-LBS.



DETAIL C - TYPICAL SCREW PATTERN FOR ITEM 23.

LOCATION OF THE 10 SPRINGS, ORIENTATION OF THE HOLES IS OPTIONAL.



DETAIL B - TYPICAL SPRING PATTERN FOR ITEM 6.



GENERAL LOCATION NON-FLIGHT ITEM

10481705

1. #10-32-7/8	PNEUMATIC 1-INCH SHUTOFF VALVE ("A" REV. and EO-1A)	28. 76NA016	PREFORMED PACKING (O-RING) (H) (H)
2. 198H002	SOCKET HEAD CAP SCREW (8 PLACES) (A) (A) (A) (A) (A) (A) (A) (A)	29. 468G004	SHAFT COUPLING (H) (H)
3. 34FA001	SPACER (8 PLACES)	30. 22ND-12-02	SPLINE NUT (ESNA CORP) (2 PLACES) (H)
4. 33K9001	FITTING	31. #10-32-3/4	SOCKET HEAD CAP SCREW (X) (X)
5. 32AN001	GASKET	32. 29FT003	ACTUATOR MOUNTING
6. 58KA001	SPRING (10 PLACES) (C) (C)	33. 76NA009	PREFORMED PACKING (O-RING) (H) (H)
7. 350K002	SPRING RETAINER	34. #10-32-3/4	SOCKET HEAD CAP SCREW (4 PLACES) (X) (X)
8. 10FK001	RETAINER INSERT	35. 43BV002	LOWER BUSHING
9. 3591-3CHU-.285	BALL (H)	36. 13CG003	DRIVE SHAFT (A)
10. 11GA001	SCREW LOCKING INSERT (NELI-COIL) (8 PLACES) (H)	37. 510E012	NAMEPLATE "CLOSE"
11. 117412	BODY	38. #8-32-1/2	SOCKET HEAD CAP SCREW (4 PLACES) (X) (X)
12. #00-1/8	NAMEPLATE	39. 34AA010	ACTUATOR FITTING
13. 3591-4CHU-3/8	DRIVE SCREW (TYPE "U") (4 PLACES)	40. 76NA213	PREFORMED PACKING (O-RING) (H) (H)
14. 23G0001	SCREW LOCKING INSERT (NELI-COIL) (4 PLACES) (H)	41. 14CG002	PISTON (A) (A)
14.1 22GM001	SEAT ASSEMBLY	42. 16NG002	LINK PIN (A) (A)
14.2 20GM001	SEAT	43. 15EG001	LINK (L) (L)
14.3 47KC001	SEAT RETAINER	44. 16NG001	BELLCRANK PIN (L) (L)
15. 3591-3CHU-.285	CUP	45. 40ED002	BELLCRANK (A) (A)
16. 3591-3CHU-.285	SCREW LOCKING INSERT (NELI-COIL) (4 PLACES) (H)	46. 3585-2CHU-.246	SCREW LOCKING INSERT (NELI-COIL) (4 PLACES) (H)
17. 13DG001	SCREW LOCKING INSERT (NELI-COIL) (6 PLACES) (H)	47. 3591-3CHU-.285	SCREW LOCKING INSERT (NELI-COIL) (H)
18. 43CM002	SHAFT (H)	48. 28CG003	ACTUATOR BODY
19. 26CS005	SHAFT BUSHING	49. #10-32-3/4	SOCKET HEAD CAP SCREW (2 PLACES) (X) (X)
20. 26CK006	SHAFT SEAL	50. 510E011	NAMEPLATE "OPEN"
21. 18HW001	SHAFT SEAL	51. 43AV001	UPPER BUSHING
22. 34FA001	THRUST WASHER	52. 24OF001	GASKET
23. 58JA006	RING	53. #8-32-3/8	SOCKET HEAD CAP SCREW (4 PLACES) (X) (X)
24. 198H002	SEAL RETAINER	54. 24O0E8	SWITCH ASSEMBLY
25. #10-32-7/8	SPACER (6 PLACES)	54.1 3585-04CHU-.168	SCREW LOCKING INSERT (NELI-COIL) (4 PLACES) (H)
26. 58H002	SOCKET HEAD CAP SCREW (6 PLACES) (A)	54.2 76NA017	PREFORMED PACKING (O-RING) (H) (H)
27. 41FW005	BONNET RETAINER	54.3 MS3102E-14S-2P	CONNECTOR
	BONNET	54.4 AN500D4-5	SCREW (4 PLACES)
		54.5 MS2099SC20	LOCKWIRE (H)

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) OR APPROVED EQUIVALENT.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) TORQUE INITIALLY TO 35 INCH-POUNDS IN THE SEQUENCE SHOWN IN DETAIL A. THEN TORQUE TO 45 INCH-POUNDS IN THE SAME SEQUENCE.
- (G) INSTALL SPRINGS IN SPRING RETAINER (6) AS SHOWN IN DETAIL B.
- (H) LUBRICATE WITH MOLYKOTE TYPE 2 OR APPROVED EQUIVALENT.
- (I) TORQUE INITIALLY TO 25 INCH-POUNDS IN THE SEQUENCE SHOWN IN DETAIL C. THEN TORQUE TO 45 INCH-POUNDS IN THE SAME SEQUENCE.
- (J) TORQUE 35 TO 45 INCH-POUNDS.
- (K) LUBRICATE WITH DOM-CORNING BC-55 OR APPROVED EQUIVALENT.
- (L) LOCKWIRE IN ACCORDANCE WITH MS33540.

DRAWN BY:	<i>R.A. [Signature]</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10481705	REVISION DATE OF THIS PAGE
PLANNER:	<i>W.B. [Signature]</i>	A	BO'S	-1A	
WRITER:	<i>L.F. Allen</i>		ART CONTROL NO.	M-MS-EP140-638	
APPROVED BY:	<i>M. [Signature]</i>				

MANUFACTURING PLAN



NOTES:

1. SEE PAGE 4 FOR THE 10481055 PNEUMATIC -INCH SHUTOFF VALVE EFFECTIVITY
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ARE 690 BY 588 BY 3.34 INCHES
3. THE APPROXIMATE UNIT WEIGHT IS 420 POUNDS
4. SWITCH ASSEMBLY (54) NOT SHOWN ON CUTAWAY VIEW FOR CLARITY

ROTATED 22.5°
CLOCKWISE FOR
CLARITY

3.3 Drawings:

Ordnance Corps - 10481709
10509300
10509302
10509305
10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"A" Rev.
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev. and EO-1A
SPARES	Before installing modify to latest configuration.

10481705

REVISION DATE

DATA SHEET	
Nomenclature: Valve (Sequence Fuel Igniter)	
Drawing Numbers: 403520 Saturn I Vehicle	Vendor: North American Aviation, Rocketdyne Corp. Location: S-I Stage
Estimated Design Life: 2500 cy.	
Failure Rate: $2066 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 50 Number of Failures Reported: 1	MCBF (in cycles): 484 Total Cycles of Operation: 484 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965 (Revision)

II.10.1
Page 1 of 5

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-8 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 403520 component:

The spring loaded, normally closed fuel igniter valve, actuated by a cam located on the main LOX valve (MLV), controls fuel flow to the hypergol container and to the ignition monitor valve (IMV). The fuel igniter valve begins to open when the MLV is approximately 38 % open, and becomes fully opened when the MLV is approximately 70% open. A heater, attached to the fuel igniter valve, prevents O-ring freezing caused by the MLV's low temperature.

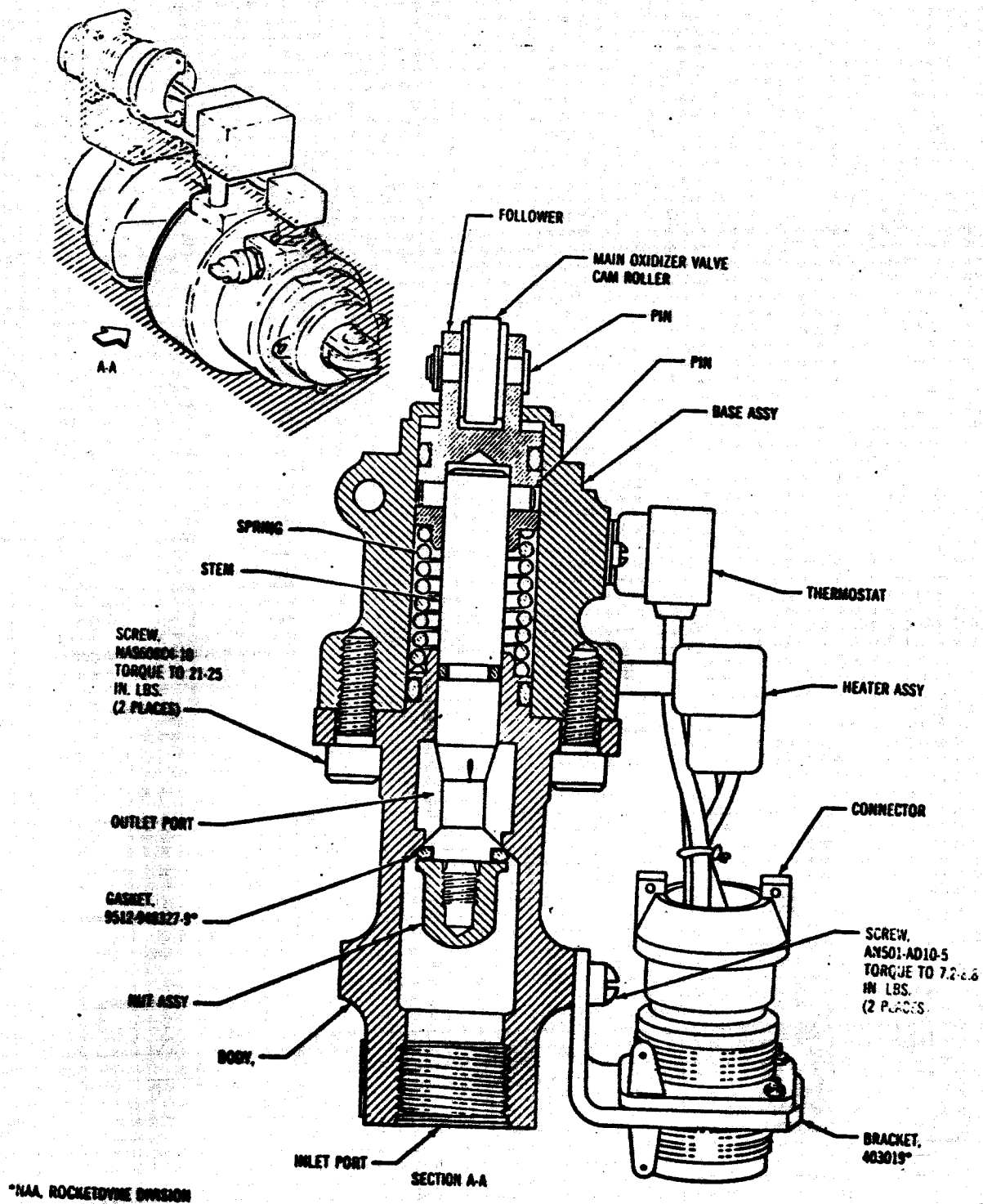
1. Vendor - Rocketdyne Division, North American Aviation, Inc., Part No. 403520
2. Location - Station 94
3. Service - RP-1 fuel
4. Thermostat -
 - a. Opens at increasing temperature at $130 \pm 8^{\circ}\text{F}$
 - b. Closes at decreasing temperature of $110 \pm 5^{\circ}\text{F}$
5. Pressure - Proof: 1650 psig
6. Leakage -
 - a. External: With valve partially opened, purge and outlet ports plugged
 - (1) 5 psig to inlet port - zero leakage from vent port
 - (2) 825 ± 25 to inlet port - zero leakage from vent port
 - (3) 5 psig to vent port with inlet port plugged - zero leakage at:
 - a. Joint between body and base
 - b. Between follower and base

- b. Seat: With valve closed and purge port plugged
 - (1) 5 psig to inlet port - maximum of 0.1 cc per minute from outlet port
 - (2) 825 ± 25 psig to inlet port - maximum of 0.1 cc per minute from outlet port

7. Electrical Characteristics -

- a. Thermostat: After minimum of two cycles, thermostat is to maintain temperature of valve body between 70 and 150°F
- b. Insulation resistance:
 - (1) Required:
 - a. Temperature of valve to be between 60 and 80°F
 - b. 500 volts dc applied across valve body and each pin of electrical connector
 - (2) Result: A minimum of 50 megohms resistance across valve body and each pin

One failure was reported on an Inspection Report.



FUEL IGNITER VALVE, 403520 - SECTIONAL VIEW

DATA SHEET	
Nomenclature: Valve (Camera Lens Purge)	
Drawing Numbers: 20M30419	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $6153 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 8 Number of Failures Reported: 2	MCRF (in cycles): 162.5 Total Cycles of Operation: 325 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>2</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30419 valve:

The two failures were reported on Inspection Reports.

(Intentionally Left Blank)

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN		DATE		PROCEDURE	
TITLE		6 November 1962		MP1-2000	
SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30419 SOLENOID OPERATED, PILOTED, 2 WAY, CONTROL VALVE		APPROVED <i>J. G. [Signature]</i>		PAGE 1 of 4	

1. DESCRIPTION.

The solenoid operated, piloted, 2 way, control valve 20M30419 is a component of the LOX tank cameras purge-heater system. In the cameras purge-heater system the GN₂ used to prevent fogging of the optical surfaces of the LOX tank cameras is vented to the atmosphere through the control valve. For approximately 30 minutes prior to LOX tanking until lift-off, GN₂ is supplied to the system through the quick disconnect coupling nipple 20M30403 in throw-out plugs plate assembly 75M01262. At lift-off the control valve is closed and remains closed during flight to seal the dry GN₂ within the system. The control valve is installed on the aft side of the spider beam assembly between fin lines II and III as shown in the installation view. The various functional characteristics of the control valve are as follows:

1.1 Mechanical Performance Characteristics. The control valve is capable of performing mechanically as follows:

- Operating media: Air or gaseous nitrogen.
- Nominal operating pressure: 30 to 300 p.s.i.g. internal pneumatic pressure.
- Proof operating pressure: 450 p.s.i.g. internal pneumatic pressure.
- Burst pressure (without rupture): 750 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- Operating temperature range: -65° to +165° F.
- Minimum flow capacity equivalent: A sharp-edged orifice of 0.430-inch diameter with a discharge coefficient (C_d) of 0.60 while pressurized to 30 p.s.i.g. pneumatic pressure.
- Leakage past main seat (valve closed): 5 s.c.i.m. maximum with an internal pneumatic pressure ranging from 0 to 300 p.s.i.g. applied to the inlet port.
- External leakage: 2 cc. per hour maximum with 300 p.s.i.g. pneumatic pressure applied to the inlet port.
- Life cycle: 2,000 operating cycles without damage or impairment of performance.

1.2 Electrical Performance Characteristics. The electrical performance characteristics of the control valve are as follows:

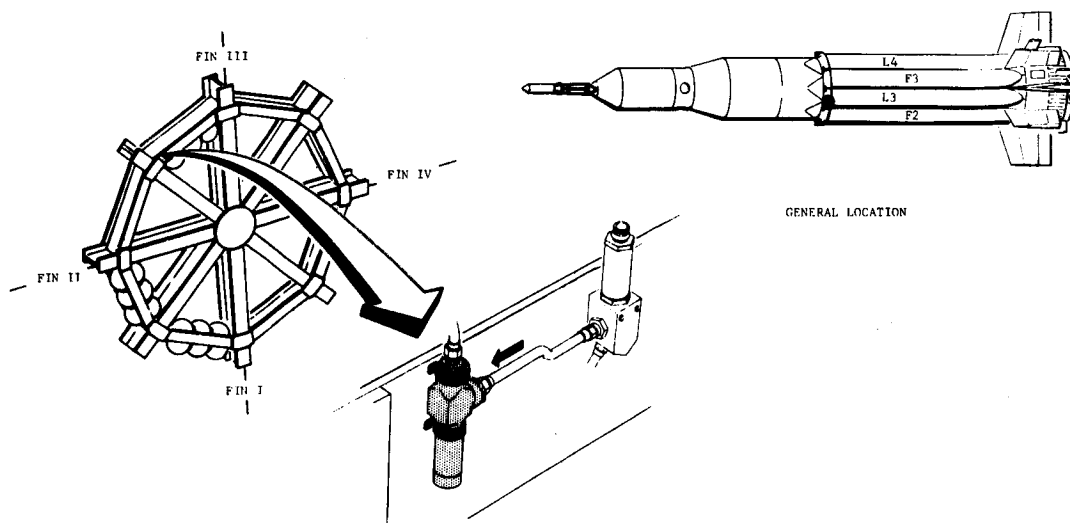
- Operating voltage: 18 to 32 v.d.c. with 28 v.d.c. nominal.
- Operating current: 2.5 a. maximum at 28 v.d.c.
- Minimum operating voltage with the inlet port pressurized to 300 p.s.i.g.: To open - increasing voltage to 18 v.d.c. To close - decreasing voltage in the range from 10 v.d.c. maximum to 1 v.d.c. minimum.
- Solenoid continuous duty performance requirement: 24 hours with 28 v.d.c. applied.
- Insulation resistance: 50 megohms minimum with 500 v.d.c. applied between each isolated electrical connector terminal and the valve body.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

REVISION DATE

(Continued on page 4)

20M30419



INSTALLATION VIEW - SPIDER BEAM ASSEMBLY
(ARROW INDICATES FLOW DIRECTION)

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH MSFC-STD-103.
- (D) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (E) OR APPROVED EQUIVALENT.
- (F) LUBRICATE WITH DOW-CORNING CORP., D.C. 55 GREASE OR APPROVED EQUIVALENT.
- (G) TORQUE 7 TO 9 INCH-POUNDS.
- (H) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (J) TORQUE 70 TO 120 INCH-POUNDS.
- (K) TORQUE 20 TO 25 INCH-POUNDS.
- (L) SOLDER IN ACCORDANCE WITH MSFC-PROC-158.

LEGEND

20M30419

1. AN535-00-2
2. 117911
3. 103982
4. 206521
5. J200A115
6. 207151
7. 103931
8. 5000-56C
9. 119251
10. 109001
11. AN340C8
12. 1608-00
13. 119202
14. 100691
15. AN995C20
16. 201572
17. 110161
18. 201541
19. J4A1
20. 202131
21. AN936A416
22. 107721
23. J200A114
- 24.
25. AN3102E-10SL-4P
26. AN936A4
27. AN515C4.5

SOLENOID OPERATED, PILOTED, 2 WAY,
CONTROL VALVE (MAROTTA VALVE CORP.
PART 206463, MODEL MV-36J) (A) (B)

(C) (D) (E)

ROUND HEAD DRIVE SCREW (4 PLACES)

NAMEPLATE

BODY

POPPET MACHINING ASSEMBLY (F) (F)

PREFORMED PACKING (O-RING) (F) (F)

STEM AND POPPET ASSEMBLY (F) (F)

POPPET WASHER

RETAINING RING (WALDES KOHINOOR INC.,
LONG ISLAND CITY, N. Y.) (E)

SPRING RETAINER

SPRING

NUT (C)

WASHER (SHAKEPROOF CO., CHICAGO, ILL., (I)

PLINGER (F)

SCREW

LOCKWIRE (H)

COVER MACHINING ASSEMBLY (J)

SHIM WASHER (AS REQUIRED)

COIL ASSEMBLY

PREFORMED PACKING (O-RING) (E) (F)

ADAPTER ASSEMBLY

TOOTH LOCK WASHER

NUT (K)

PREFORMED PACKING (O-RING) (E) (F)

ELECTRICAL WIRING (MIL-W-16878) (L)

ELECTRICAL RECEPTACLE

TOOTH LOCK WASHER (4 PLACES)

SCREW (4 PLACES)

DRAWN BY: CASTLE	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30419	REVISION DATE OF THIS PAGE
PLANNER: H. Phillips		EO's	
WRITER: G. E. Schenk			
APPROVED BY: M. W. Schmitt		ART CONTROL NO. M-ME-E-890	

MSFC - Form 1151-1 (June 1964)

II.11.1

Page 6 of 8

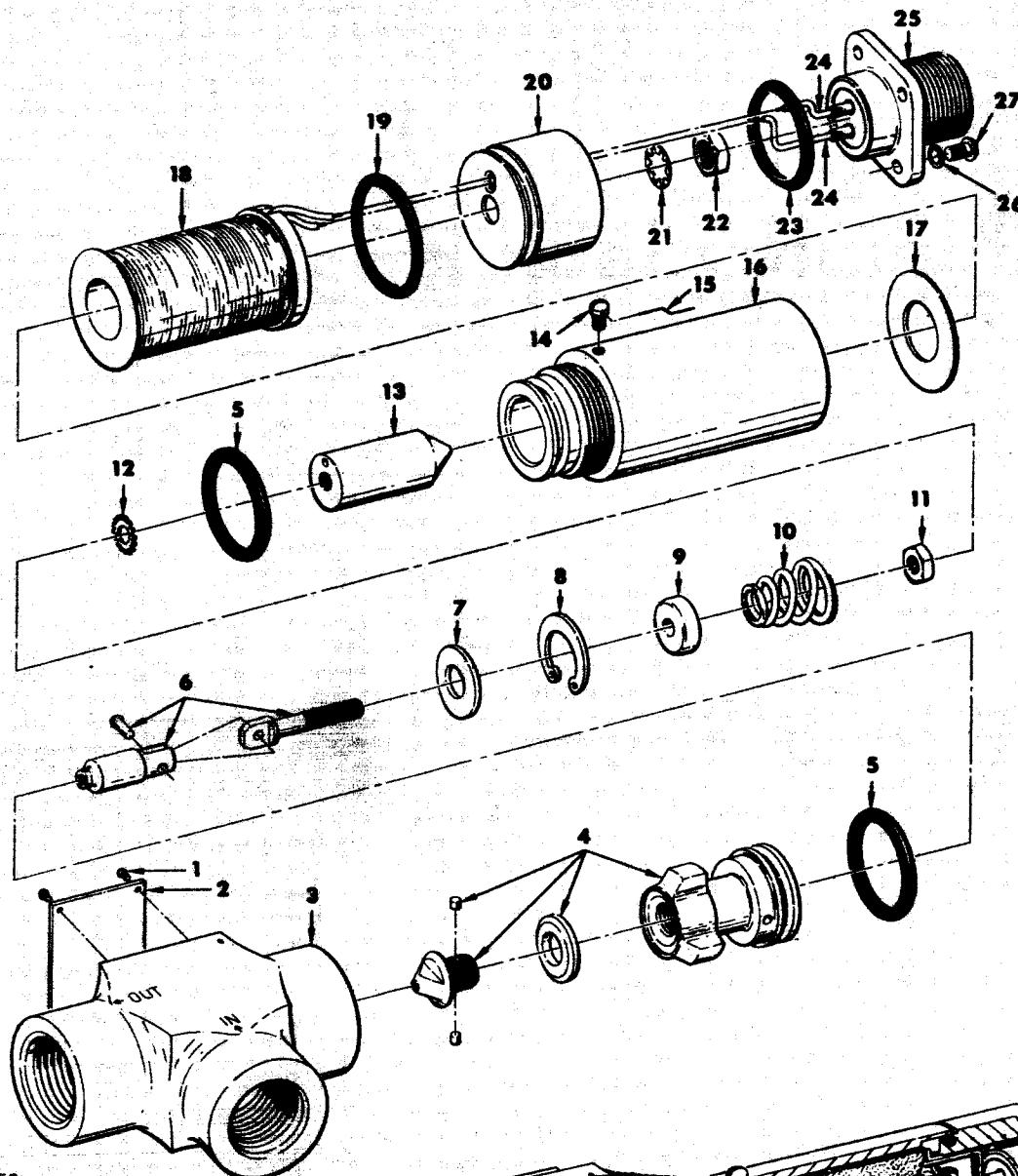
MANUFACTURING PLAN

PROCEDURE

MP1-2000.

PAGE

3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 20M30419 SOLENOID OPERATED, PILOTED, 2 WAY, CONTROL VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE CONTROL VALVE ARE 5.58 BY 2.01 BY 1.31 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 1.25 POUNDS.

3 LBS. PER MIN. OF DRY
GN₂ @ 70° ± 20° F. APPROX.
TO ATMOSPHERE

30 TO 300 PSIG. GN₂

REVISION DATE

M-ME-E-890

20M30419

MSFC - Form 1151-2 (June 1961)

1.3 Shock Withstanding Capability. The control valve is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes with the inlet port pressurized to 60 p.s.i.g. pneumatic pressure:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The control valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions with the inlet port pressurized to 60 p.s.i.g. pneumatic pressure:

- 20 to 55 c.p.s. at 3.0 g's,
- 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
- 100 to 2,000 c.p.s. at 10.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the control valve are outlined in Performance Specification 10M01623 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858
MIL-W-16878
NASA - MSFC-SPEC-164
MSFC-PROC-158

3.2 Standards:

Military - MIL-STD-130
MS33540
NASA - MSFC-STD-105
Army Ballistic Missile
Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302
10509303
MSFC - 10419909
10M01623

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	
SA-6	
SA-7	
SA-8	
SA-9	
SA-10	
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30419

REVISION DATE

MSFC - Form 1151-1 (June 1961)

SUMMARY SHEET

Nomenclature Valve (Calorimeter Purge Control)

Drawing Numbers: 10414093
20M30160

Vendor: Marotta Valve Corp.

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 2,000 cy.

Failure Rate: $1517 \times 10^{-6}/\text{cy.}$

MCBF (in cycles): 659.2

Total Number of Components
this Data Represents: 27

Total Cycles of Operation:
913

Total Number of
Failures Reported: 0

Vehicle Equipment: X
Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-9 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valve (Calorimeter Purge Control)	
Drawing Numbers: 10414093	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: 5893 $\times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 15 Number of Failures Reported: 0	MCBF (in cycles): 169.7 Total Cycles of Operation: 235 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: (No data available)	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Valve (Calorimeter Purge Control)	
Drawing Numbers: 20M30160	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: 2043 $\times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 12 Number of Failures Reported: 0	MCBF (in cycles): 489.5 Total Cycles of Operation: 678 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-5 through SA-9 Vehicles (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30160 2 WAY, 2 POSITION, NC, SOLENOID OPERATED VALVE ASSEMBLY				22 June 1962	MP1-2000
				APPROVED <i>J. H. [Signature]</i>	PAGE 1 OF 4

1. DESCRIPTION.

The 2 way, 2 position, NC, solenoid operated valve assembly 20M30160 is a component of the control pressure system. The valve assembly used in the calorimeter purge line of the control pressure system is opened to allow GN₂ from the high pressure storage spheres to flow into the calorimeters to purge them during flight. The valve assembly used in the calorimeter purge line is located in the aft end of the tail unit assembly near fin III as shown in the installation view. The various functional characteristics of the valve assembly are as follows:

1.1 Pneumatic Operating Characteristics. The valve assembly is capable of operating pneumatically as follows:

- a. Operating temperature range: -65° to +165° F.
- b. Service media: Air and gaseous nitrogen.
- c. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- d. Proof operating pressure: 1,125 p.s.i.g. internal pneumatic pressure.
- e. Burst pressure (without bursting): 1,875 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- f. Flow capacity equivalent: A sharp-edged orifice of 0.170-inch diameter with 750 p.s.i.g. pneumatic pressure applied.
- g. Leakage past the main valve seal with valve in closed position and internal pressure of 750 p.s.i.g.: 5 s.c.i.m. maximum.
- h. External leakage with the valve in open position: None allowed.

1.2 Electrical Performance Characteristics. The electrical performance characteristics of the valve assembly are as follows:

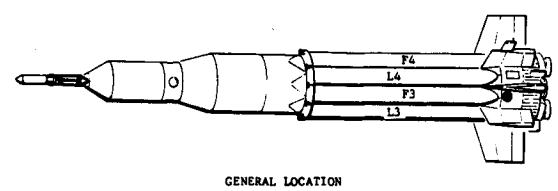
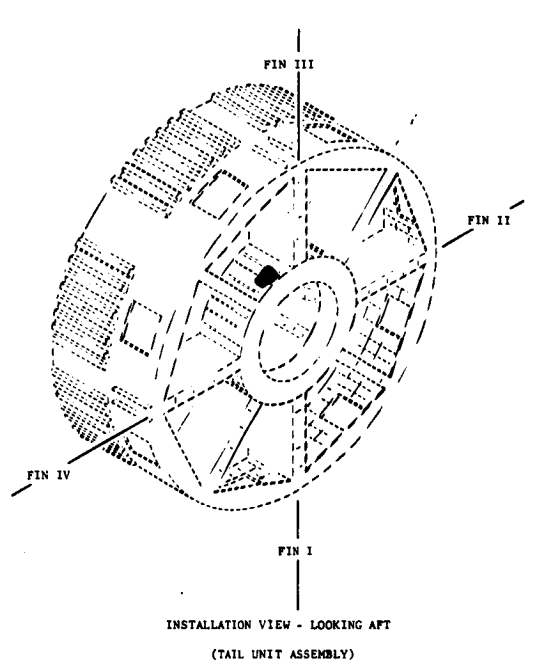
- a. Operating voltage range: 22 to 32 v.d.c. with 28 v.d.c. nominal.
- b. Insulation resistance: 50 megohms minimum with 500 v.d.c. applied between each isolated connector terminal and the valve body.
- c. Solenoid voltage endurance: 28 v.d.c. for a minimum of 4 hours.
- d. Operating current: 1.5 a. with 28 v.d.c. applied.
- e. Solenoid operating voltage: 18 v.d.c. maximum to open. 10 v.d.c. maximum to 2 v.d.c. minimum to close.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 65 g's in each of the three major axes with the inlet port pressurized to 750 plus or minus 10 p.s.i.g.:

(Continued on page 4)

REVISION DATE	20M30160
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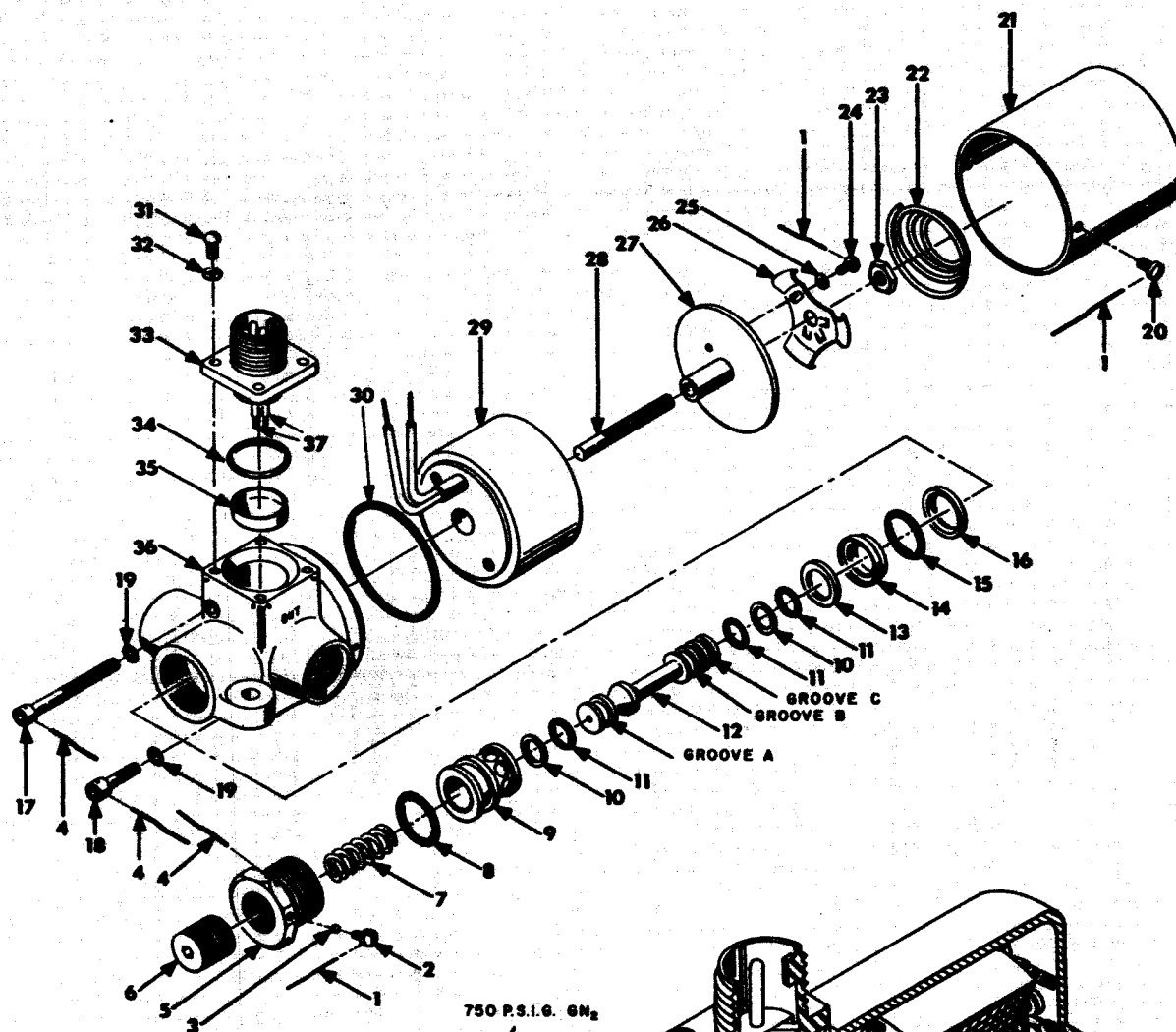


- NOTES
- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
 - (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - (C) STAMP THE CURS DATE OF OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
 - (D) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
 - (E) OR APPROVED EQUIVALENT.
 - (F) LOCKWIRE IN ACCORDANCE WITH M633540.
 - (G) TORQUE 650 TO 800 INCH-POUNDS.
 - (H) LUBRICATE WITH DOW-CORNING CORP., D.C. 55 OR APPROVED EQUIVALENT.
 - (J) LUBRICATE THE SLIDING SURFACES WITH DOW-CORNING CORP., D.C. 55 OR APPROVED EQUIVALENT.
 - (K) TORQUE 4 TO 6 INCH-POUNDS.
 - (L) TORQUE 8 TO 10 INCH-POUNDS.
 - (M) LOCATE RECEPTACLE KEY TOWARD COIL AS SHOWN.
 - (N) SOLDER IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300.

- 20M30160
- | | | | |
|-----|-----------------|---|---------------------|
| 1. | AN995C20 | 2 WAY, 2 POSITION, NC, SOLENOID OPERATED VALVE ASSEMBLY (MAROTTA VALVE CORP., BOONTON, NEW JERSEY, 205903-12) | (A) (B) (C) (D) (E) |
| 2. | J67A12 | LOCKWIRE | (F) |
| 3. | 106481 | LOCKWIRE SCREW | |
| 4. | MS20995C32 | LOCKING SLUG | |
| 5. | 118172 | LOCKWIRE | (P) |
| 6. | 118161-1 | RETAINING NUT | (C) |
| 7. | 110421 | ADJUSTING SCREW | |
| 8. | J200A112 | POPPET SPRING | |
| 9. | 134042-1 | PREFORMED PACKING (O-RING) | (E) (H) |
| 10. | 108241-10 | SEAT RETAINER | |
| 11. | J200A10 | BACKUP WASHER | (E) |
| 12. | 120612-1 | PREFORMED PACKING (O-RING) | (E) (H) |
| 13. | 129861-1 | VALVE POPPET | (J) |
| 14. | 129872-1 | POPPET SEAT | |
| 15. | J200A14 | SEAT SUPPORT | |
| 16. | 115771-3 | PREFORMED PACKING (O-RING) | (E) (H) |
| 17. | 113591-2 | SEAT SUPPORT | |
| 18. | 113591-3 | CORE SCREW | (K) |
| 19. | J200A2 | CORE SCREW | (K) |
| 20. | 102961 | PREFORMED PACKING (O-RING) | (E) (H) |
| 21. | 122371-2 | COVER SCREW (2 PLACES) | |
| 22. | 108031 | COIL COVER | |
| 23. | 107281 | SPRING | |
| 24. | 107291 | ARMATURE LOCK NUT | (L) |
| 25. | 107331 | LOCKWIRE SCREW | |
| 26. | 108043 | FLAT WASHER | |
| 27. | 203031-2 | ARMATURE CLIP AND LOCK | |
| 28. | J8B11 | ARMATURE AND GUIDE ASSEMBLY | |
| 29. | 212272-1311 | ARMATURE STUD | |
| 30. | J200A30 | COIL AND CORE ASSEMBLY | |
| 31. | AN313C4-5 | PREFORMED PACKING (O-RING) | (E) (H) |
| 32. | AN936A-4 | SCREW (4 PLACES) | |
| 33. | MS3102E-10SL-4P | TOOTH LOCK WASHER (4 PLACES) | |
| | | ELECTRICAL RECEPTACLE (BENDIX PART 10-69211) | (M) |
| 34. | J200B113 | PREFORMED PACKING (O-RING) | (E) (H) |
| 35. | 107311 | RECEPTACLE INSULATOR | |
| 36. | 122564 | VALVE BODY | |
| 37. | | ELECTRICAL WIRING (MIL-W-5086) | (N) |

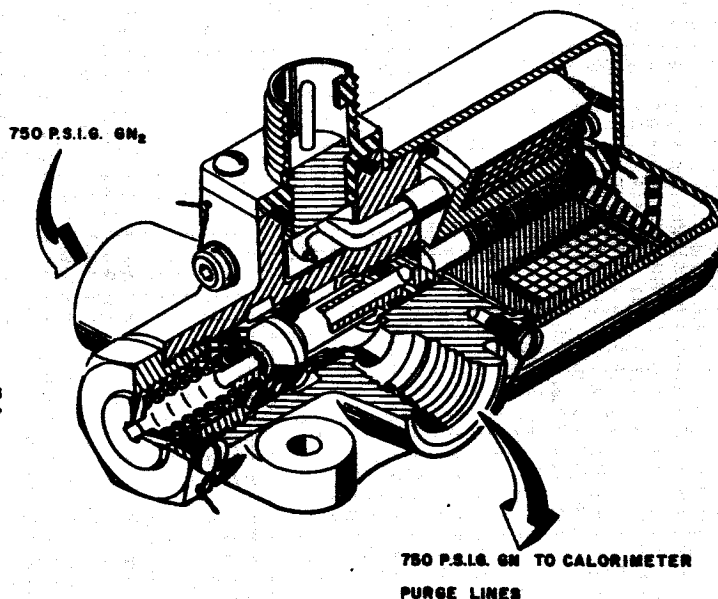
DRAWN BY:	<i>J. B. B.</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30160	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. E. Bennett</i>		E O's	
WRITER:	<i>A. G. G. G.</i>			
APPROVED BY:	<i>J. J. J. J.</i>		ART CONTROL NO. M-ME-2000-797	

MANUFACTURING PLAN

PROCEDURE
MP1-2000PAGE
3 of 4

NOTES:

1. SEE PAGE 4 FOR THE 20M30160 2 WAY, 2 POSITION, NC, SOLENOID OPERATED VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 4.06 BY 2.13 BY 1.86 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 1.05 POUNDS.



M-ME-2000-787

20M30160

1.3 Shock Withstanding Capability. (con.)

10-milliseconds duration - triangular wave, or
 8-milliseconds duration - sine wave, or
 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 5.0 g's,
 55 to 95 c.p.s. at 0.03-inch double amplitude displacement, and
 95 to 2,000 c.p.s. at 15 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve assembly are outlined in Performance Specification 10M01146 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 MIL-Q-9858
 MIL-W-5086

3.2 Standards:

Military - MIL-STD-130
 MS33540
 Army Ballistic Missile
 Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302
 10509303
 10509305
 10509311
 10M01146

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	
SA-6	
SA-7	
SA-8	
SA-9	
SA-10	
Spares	Before installing modify to latest configuration

20M30160

REVISION DATE

MSFC - Form 1181-1 (June 1961)

DATA SHEET

Nomenclature: Valve, Purge LOX/SOX

Drawing Numbers: 60C27927

Vendor: Marotta Valve Corp.

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 2000 cy.

Failure Rate: 1058 x 10⁻⁶/cy.

MCBF (in cycles): 944.5

Number of Components
this Data Represents: 19

Total Cycles of Operation:
1889

Number of
Failures Reported: 2

Vehicle Equipment: X
Ground Equipment:

ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available

Acceleration:

Altitude:

Radio Interference:

Salt Spray:

Shock:

High Temperature:

Low Temperature:

Ambient Room Temperature:

Thermal Shock:

Shock Impact (Flat Drop):

Leakage Rate:

Humidity:

Random Noise:

Sine Wave Method:

Vibration:

December 1965

II.11.3
Page 1 of 5

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 60C27927 component:

Two failures were reported on Inspection Reports.

1. Vendor - Marotta Valve Corp., Part No. 219664-1
2. Location -
 - a. One valve at Station 922, fuel tank No. 3
 - b. One valve at Station 923, fuel tank No. 4
 - c. One valve at Station 923, fuel tank No. 1
3. Service - GN_2
4. Temperature - Operating: 125 to -65°F
5. Pressure -
 - a. Operating: 3000 psig
 - b. Proof: 4500 psig
 - c. Burst: 7500 psig
6. Lubrication - Lubricate seals and sliding surfaces with DC-55 grease (Dow Corning)
7. Leakage -
 - a. Internal:
 - (1) Main seat: 5 scim maximum at 300 to 3000 psig
 - (2) Poppet stem vent: Not to exceed 2 scim when pressurized at 300 to 3000 psig
 - (3) Pilot valve assembly: 5 scim maximum when inlet port is pressurized at 300 to 3000 psig
 - b. External: 2 scim maximum at 3000 psig
8. Electrical Characteristics -
 - a. Operating current: 1.2 amperes at 28 ± 0.5 vdc with pilot valve assembly solenoid energized
 - b. Operating voltage: 22 to 32 vdc

December 1965

II.11.3
Page 3 of 5

c. Insulation resistance:

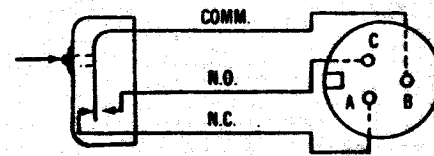
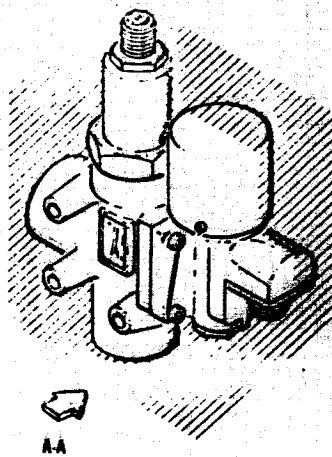
- (1) Each terminal of pilot valve solenoid connector to valve body: 50 megohms, minimum
- (2) Each terminal of position switch connector to valve body: 50 megohms, minimum

d. Position switch indications:

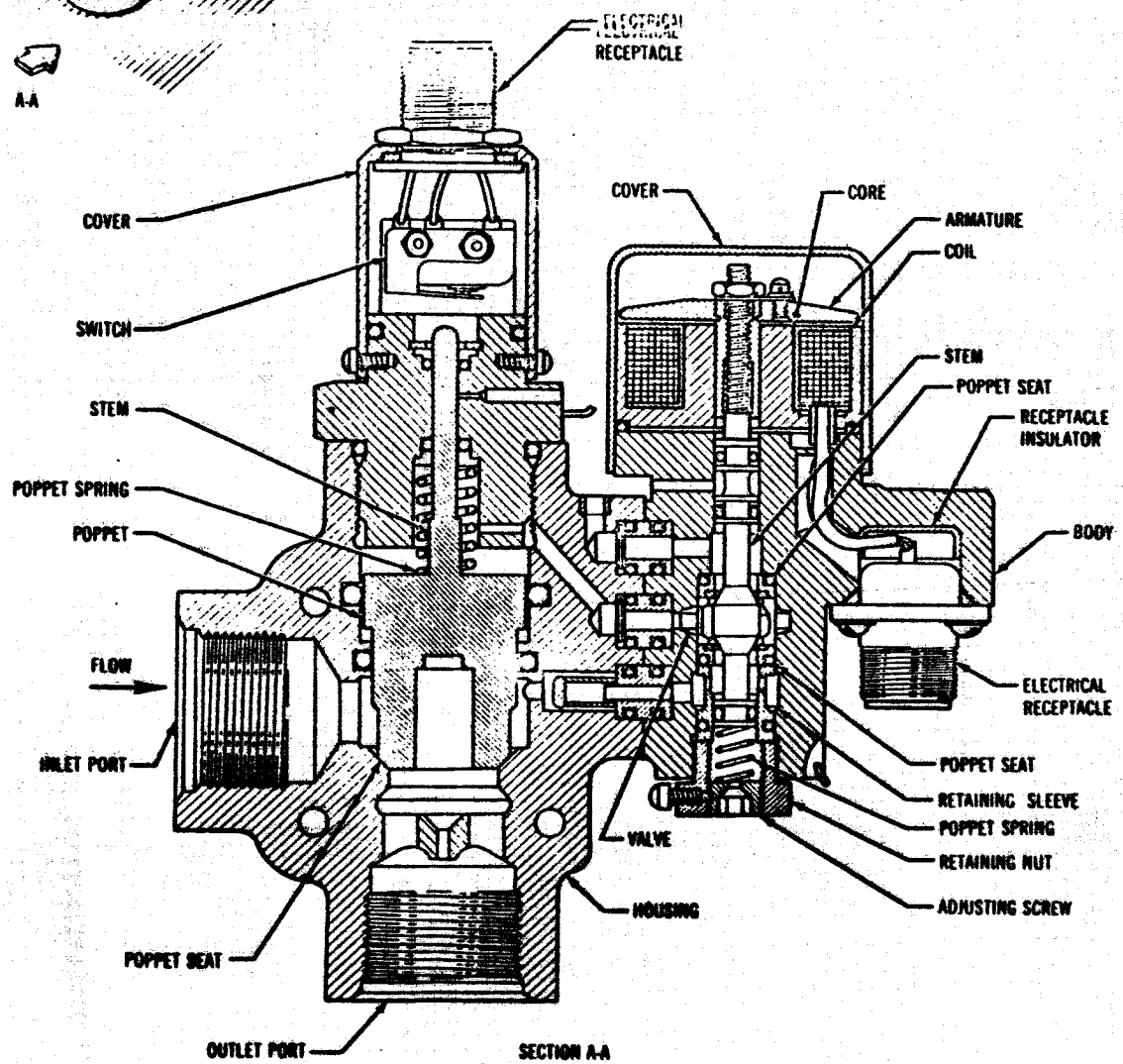
- (1) Closed: Pins A and B show continuity
- (2) Open: Pins B and C show continuity

e. Solenoid action:

- (1) Open: With inlet port pressure of 3000 psig, pilot valve solenoid shall actuate main valve from fully closed to fully open at increasing voltage of 18 volts d.c.
- (2) Closed: Main valve shall close at 10 vdc maximum, 2.0 vdc minimum



INDICATOR WIRING DIAGRAM



DATA SHEET	
Nomenclature: Valve (Multi-Application*)	
Drawing Numbers: 10414027	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: 199 x 10 ⁻⁶ /cy.	MCBF (in cycles): 5033
Number of Components this Data Represents: 76	Total Cycles of Operation: 10,067**
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: Internal and external - none at 750 psig.	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

- * See page 3, II.12.1
 ** Minimum operating time; serial no. 222 was
 not included on running cycle logs.

II.12.1.2
 Page 1 of 8

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>1</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-62-5, January 21, 1962 MSFC			

Additional information concerning the 10414027 component:

Two failures were reported on Inspection Reports.

The multi-application valve is used as a pre-valve, vent valve, lock interconnect valve, replenishing valve, control valve.

December 1965

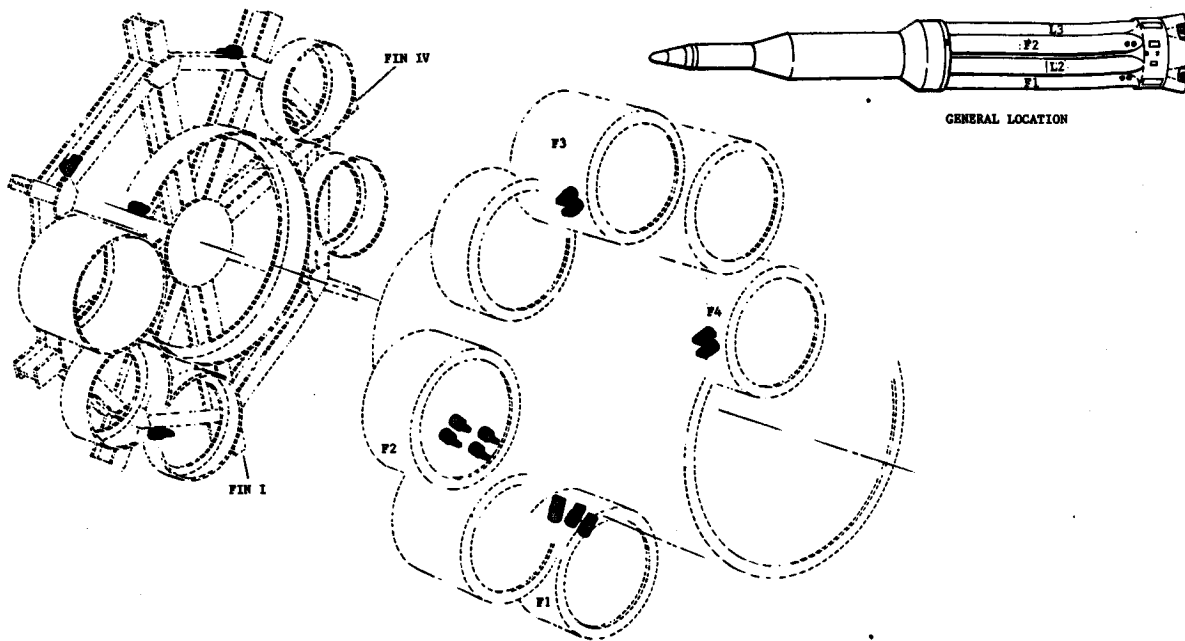
II.12.1.2
Page 3 of 8

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MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE 11 August 1961
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414027 MV-74V CONTROL VALVE		PROCEDURE NO. EP-140
		APPROVED <i>R. Ruff</i> PAGE 1 OF 4
<p>1. DESCRIPTION.</p> <p>The MV-74V control valve 10414027 is a three-way, two-position, normally closed or normally open electro-pneumatically operated control valve. Fifteen of the valves are used in the control pressure system to supply the actuating pneumatic pressure to 25 pneumatic-mechanical valves in the LOX and fuel systems. Also, the valve is used as a component of the valve and orifice assemblies 10414091, 10414310, and 10414355. All of the valves are normally closed except one of the two located in the rear skirt of container F2 that is used to actuate the LOX replenishing valve assembly 10414003. The valves located just forward of containers F1 and F3 on the spider beam control the 10414021 fuel vent valve assembly No. 1 and No. 2 respectively. The valve located just forward of container L3 on the spider beam controls the LOX vent valve assembly 10414001. The valve located just forward of container LC controls the 10414318 LOX interconnect valve and orifice assemblies No. 1, 2, 3, and 4. One of the valves located in the rear skirt of container F1 controls the fuel fill and drain valve assembly 10414352. Two valves located in the rear skirt of container F2, one normally closed the other normally open, control the LOX replenishing valve assembly 10414003. Two valves are located in the rear skirt of containers F1, F2, F3, and F4 to control the LOX preliminary valve assemblies 10414005 and the fuel preliminary valve assemblies 10414024 in the engine suction lines as follows: The valves in container F1 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 1 and No. 5. The valves in container F2 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 2 and No. 6. The valves in container F3 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 3 and No. 7. The valves in container F4 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 4 and No. 8. The various locations of the valve are shown in the installation view. The various functional characteristics of the control valve are as follows:</p> <p>1.1 Pneumatic Operating Characteristics. The control valve is capable of operating pneumatically as follows:</p> <ol style="list-style-type: none"> Operating media: Air, gaseous nitrogen, or helium. Leakage through vent port: 5 s.c.i.m. maximum with an internal pneumatic pressure of 750 ± 10 p.s.i.g. applied to the inlet port throughout the operating temperature range. Operating temperature range: Minus 65° to 165° F. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure without leakage in excess of 2 standard cubic centimeters per hour from the body or body vent while in the opened or closed position. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure. Burst pressure (without bursting): 1,875 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.) Flow capacity equivalent: A sharp-edged orifice of 0.110-inch diameter with 750 ± 10 p.s.i.g. pneumatic pressure applied. <p>1.2 Electrical Performance Characteristics. The electrical performance characteristics of the control valve are as follows:</p> <ol style="list-style-type: none"> Solenoid voltage endurance: 28 ± 1.5 v.d.c. applied to the coil continuously for 24 hours. Insulation resistance: 50 megohms minimum between pin "A" and the valve body and pin "B" and the valve body. 		

(Continued on Page 4)

REV DATE 3 NOV 1961 10414027



INSTALLATION VIEW - LOOKING FORWARD

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURB DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) OR APPROVED EQUIVALENT.
- (E) TORQUE 130 TO 180 INCH-POUNDS.
- (F) INSTALL IN SUFFICIENT NUMBERS TO LOCK THE ADJUSTING SCREW.
- (G) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (H) LUBRICATE WITH DOM-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.
- (J) TORQUE 70 TO 120 INCH-POUNDS.
- (K) TORQUE 8 TO 10 INCH-POUNDS.

LEGEND

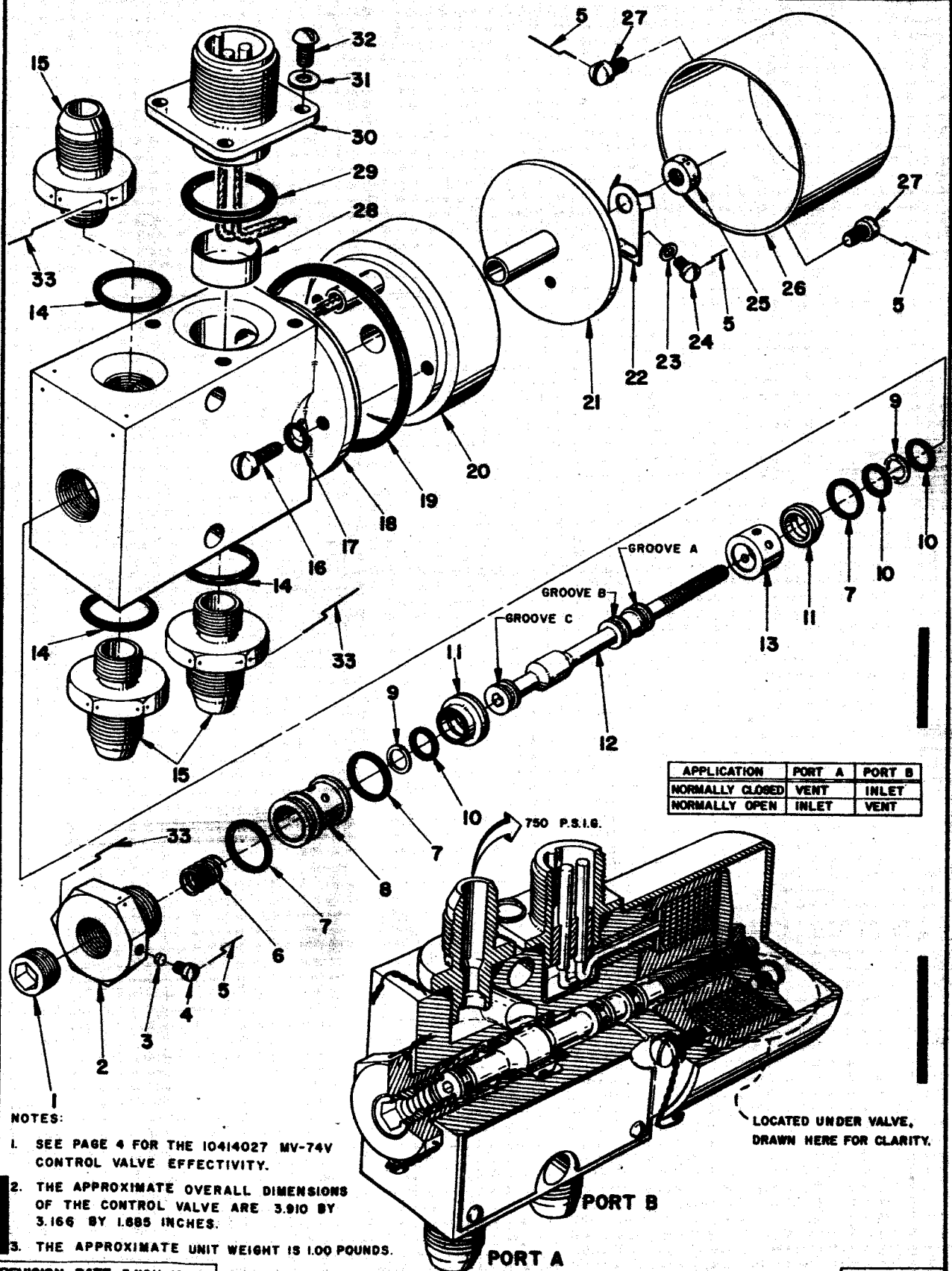
- | | |
|-------------------|---|
| 10414027 | CONTROL VALVE ("D" REV. -6, -7, & -8)
(MAROTTA VALVE CORP. 218263) (A) (B) (C) (D) |
| 1. 144621 | ADJUSTING SCREW |
| 2. 116762 | NUT (E) |
| 3. 106481 | LOCKING SLUG (F) |
| 4. J67A12 | LOCKWIRE SCREW |
| 5. MS20995C20 | LOCKWIRE (G) |
| 6. 137531 | POPPET RETURN SPRING |
| 7. J200A12 | SLEEVE AND SEAT PREFORMED PACKING
(O-RING) (D) (H) |
| 8. 102831 | RETAINING SLEEVE (H) |
| 9. 108241-1 | BACKUP WASHER |
| 10. J200A7 | SEAT PREFORMED PACKING (O-RING) (D) (H) |
| 11. 201892 | SEAT ASSEMBLY (H) |
| 12. 142602-1-2-2 | STEM (H) |
| 13. 102581 | CAGE (H) |
| 14. J201A4 | FITTING PREFORMED PACKING (O-RING) (D) (H) |
| 15. J53A3 | FITTING ASSEMBLY (J) |
| 16. 111071 | CORE SCREW (2 PLACES) |
| 17. J200A2 | CORE PREFORMED PACKING (O-RING)
(2 PLACES) (D) (H) |
| 18. 102813 | BODY |
| 19. J200A28 | COVER PREFORMED PACKING (O-RING) (D) (H) |
| 20. 213542-1112 | COIL AND CORE ASSEMBLY |
| 21. 202021 | ARMATURE ASSEMBLY |
| 22. 107261 | NUT LOCK |
| 23. 107331 | FLAT WASHER |
| 24. 107291 | LOCKWIRE SCREW |
| 25. 107281 | NUT (E) |
| 26. 102531-4 | COIL COVER |
| 27. 102961 | SCREW |
| 28. 107311 | RECEPTACLE INSULATOR |
| 29. J200B113 | SEAL PREFORMED PACKING (O-RING) (D) (H) |
| 30. MS3102E108L4P | ELECTRICAL RECEPTACLE (BENDIX PART
10-69211) (D) |
| 31. AM936A4 | WASHER (4 PLACES) |
| 32. AM515C4-5 | SCREW (4 PLACES) |
| 33. MS20995C41 | LOCKWIRE (G) |

DRAWN BY:	H. Bates	ENGINEERING DRAWING RELEASE	REVISION TO:	10414027	REVISION DATE OF THIS PAGE
PLANNER:	Wm. C. Bennett	D	EO's	-6, -7, and -8	3 Nov 1961
WRITER:	G. J. Schenk		ART. CONTROL NO.	M-F&AE-EP140-463-A	
APPROVED BY:	M. Hightower				

MANUFACTURING PLAN

PROCEDURE EP-140

PAGE 3 OF 4



M-FBAE-EP140-483-A

10414027

MANUFACTURING PLAN

1.2 Electrical Performance Characteristics. (con.)

- c. Operating current for continuous solenoid operation: 1.2 amperes when energized with a 24 ± 0.5 v.d.c. power supply.
- d. Solenoid operating voltage: Actuation - 10 to 18 v.d.c.
Deactuation - 10 to 1.0 v.d.c.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 80 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The valve is designed to withstand, without damage or excessive leakage, while pressurized to 750 p.s.i.g., vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

- 20 to 55 c.p.s. at 10 g's,
55 to 110 c.p.s. at 0.06-inch double amplitude displacement, and
110 to 2,000 c.p.s. at 40 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve is outlined in Performance Specification 10419927 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-C-5015
MIL-E-5272
MIL-L-25567
MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-202
MIL-STD-643
MS33586
MS33653
Army Ballistic Missile Agency
ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10419909
10509300
10509302
10509303
10509305
10509311

EFFECTIVITY OF 10414027

VEHICLE	REVISIONS
SA-T	"D" Rev., EO-6, -7, and -8
SA-1	"D" Rev., EO-6, -7, and -8
SA-2	"D" Rev., EO-6, -7, and -8
SA-3	"D" Rev., EO-6, -7, and -8
SA-4	"D" Rev., EO-6, -7, and -8
Spares	Before installing modify to latest configuration

10414027

REVISION DATE 3 NOV. 1961

DATA SHEET	
Nomenclature: Valve (solenoid) Multi-application	
Drawing Numbers: 20M30380	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $20,747 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 16 Number of Failures Reported: 6	MCBF (in cycles): 48.2 Total Cycles of Operation: 289* Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: 165°F Low Temperature: -65°F Ambient Room Temperature: Thermal Shock: -65 to 165°F Shock Impact (Flat Drop): 35 g for 6 milliseconds Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration: 22-55 cps at 5 g, 55-100 cps at 0.03 in. D.A. displacement, 110-2000 cps at 20 g	

December 1965 (Revision)

* Minimum total. Serial No. 811 not shown in Running Cycle Logs.

II.12.1.1
Page 1 of 3

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>4</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>2</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report M-P&VE 520, May 18, 1962, MSFC			

Additional information concerning the 20M30380 component:

The Multi-Application Solenoid Valve series in three functions.

1. Ejection of the cameras. The ejection mechanism is actuated by high pressure gaseous nitrogen at 3000 psig.
2. At completion of LOX tanks pressurization, the electrical signal is removed from the normally open valves and the purge pressure decays, allowing normal slosh measurement to start.
3. Same as item 2, for fuel tanks.

Environmental Qualification Tests Performed:

Burst Pressure: 4500 psig

NOTE: This valve was still in service and was used through the SA-9 vehicle; cycle reporting stopped at SA-4.

The six observed failures were reported on the Inspection Reports.

December 1965

II.12.1.1
Page 3 of 3.

DATA SHEET	
Nomenclature: Valve (Multi-Application*)	
Drawing Numbers: 20M30128	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $337 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 2962.1
Number of Components this Data Represents: 97	Total Cycles of Operation: 23,697
Number of Failures Reported: 8	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration: Level increased from 0 to 8 g, maintained for 3 min. in each direction	
Altitude:	
Radio Interference:	
Salt Spray: (See page 3)	
Shock: (See page 3)	
High Temperature: 165°F	
Low Temperature: -65°F	
Ambient Room Temperature: 77 ± 18°F	
Thermal Shock: Room ambient temperature increased to 125°F, maintained for 2 hr., decreased to -65°F in a period of 30 min., maintained for 2 hr.	
Shock Impact (Flat Drop):	
Leakage Rate: Internal at 750 psig - 2 scim max.; external at 3000 psig - 2 scim max.	
Humidity: 90% or less	
Random Noise:	
Sine Wave Method:	
Vibration: (See page 3)	

December 1965

* Refer to 2, II.12.1

II.12.1.3
Page 1 of 8

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>7</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: <u>1 operates</u> <u>in reverse</u>
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Marotta Valve Corp. Report QTR-MV74MP, 21 March 63			

Additional information concerning the 20M30128 component:

This valve is used as a Pre-valve, replenishing valve, LOX vent valve, relief and control valve.

Two failures were reported on Unsatisfactory Condition Reports and six on Inspection Reports.

Environmental Qualification Tests Performed

Salt spray: Temperature increased to 95°F (+2°F and -3°F), maintained for 168 hr. in salt spray fog (20% salt solution).

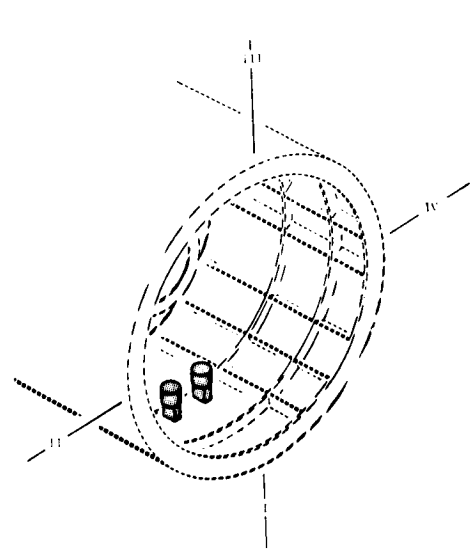
Shock: 18 impact shocks, 3 each along each of 3 mutually perpendicular axes. Each shock impulse was a triangular wave with a peak intensity of 100 g and time duration of 10 milliseconds.

Vibration: 2 frequency sweeps from 20 to 2000 cps for 5 minutes.

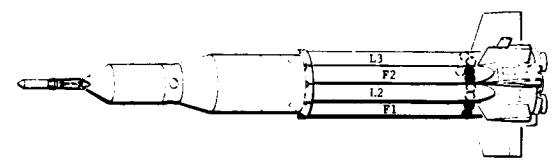
Frequency cps	Applied Vibration Amplitude
20 - 55	± 13 g
55 - 120	0.08" D.A.
120 - 2000	± 65 g

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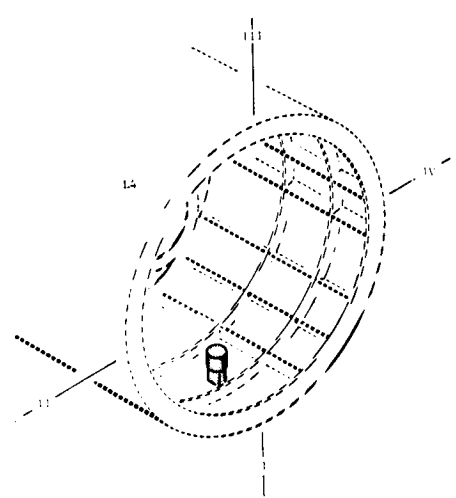
MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN		DATE		PROCEDURE NO	
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30128 MV-74V CONTROL VALVE		18 December 1961		MP1-2000	
		APPROVED <i>J. L. [Signature]</i>		PAGE 1 OF 4	
<p>1. DESCRIPTION.</p> <p>The MV-74V control valve 20M30128 is a three-way, two-position, normally closed or normally open electro-pneumatically operated control valve. Nine of the valves are used in the control pressure system to supply the actuating pneumatic pressure to 17 pneumatic-mechanical valves in the LOX and fuel systems. Also, the valve is used as a component of the valve and orifice assembly 20M30172. All of the valves are normally closed except the valve located in the rear skirt of container F2 that is used to close the LOX replenishing valve assembly 20M30045. Two valves are located in the rear skirt of containers F1, F2, F3, and F4 to control the LOX preliminary valve assemblies 20M30042 and the fuel preliminary valve assemblies 20M30043 in the engine suction lines as follows: The valves in container F1 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 1 and No. 5. The valves in container F2 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 2 and No. 6. The valves in container F3 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 3 and No. 7. The valves in container F4 control a LOX and fuel preliminary valve assembly in the suction lines of both engines No. 4 and No. 8. The various locations of the valve are shown in the installation view. The various functional characteristics of the control valve are as follows:</p> <p>1.1 <u>Pneumatic Operating Characteristics.</u> The control valve is capable of operating pneumatically as follows:</p> <ul style="list-style-type: none"> a. Operating media: Air, gaseous nitrogen, or helium. b. Leakage past main seat: 5 s.c.i.m. maximum with an internal pneumatic pressure of 750 ± 10 p.s.i.g. applied to the inlet port throughout the operating temperature range. c. External leakage: 2 standard cubic centimeters per hour maximum with internal pressure of 750 ± 10 p.s.i.g. d. Operating temperature range: -65° to $+165^{\circ}$ F. e. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure. f. Proof operating pressure: 1.125 p.s.i.g. minimum internal pneumatic pressure. g. Burst pressure (without bursting): 1,875 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.) h. Flow capacity equivalent: A sharp-edged orifice of 0.110-inch diameter with 750 ± 10 p.s.i.g. pneumatic pressure applied. <p>1.2 <u>Electrical Performance Characteristics.</u> The electrical performance characteristics of the control valve are as follows:</p> <ul style="list-style-type: none"> a. Solenoid voltage endurance: 29 ± 1 v.d.c. applied to the coil continuously for 24 hours. b. Insulation resistance: 50 megohms minimum between electrical connector pin "A" and the valve body and pin "B" and the valve body. c. Operating current for continuous solenoid operation: 1.2 a. with a $28 \pm$ v.d.c. power supply. d. Solenoid operating voltage: Actuation - 18 v.d.c. maximum. Deactuation - 10 to 3.0 v.d.c. 					
REVISION DATE		20 JUL 1962		(Continued on page 4)	
				20M30128	



INSTALLATION VIEW - LOOKING FORWARD
(TYPICAL ON CONTAINERS F1, F2, F3, AND F4)



GENERAL LOCATION



INSTALLATION VIEW - LOOKING FORWARD

- NOTES

(A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-STD-100.

(B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.

(C) STAMP THE CURE DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10309311.

(D) OR APPROVED EQUIVALENT.

(E) TORQUE 130 TO 180 INCH-POUNDS.

(F) INSTALL IN SUFFICIENT NUMBERS TO LOCK THE ADJUSTING SCREW.

(G) LOCKWIRE IN ACCORDANCE WITH MS33540.

(H) LUBRICATE WITH DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.

(J) TORQUE 8 TO 10 INCH-POUNDS.
- 20M30128

1. 144621

2. 116762

3. 106481

4. J67A12

5. MS20995C20

6. 1J7531

7. J200A12

8. 102831

9. 108241-1

10. J200A7

11. 201892

12. 142602-1-2-2

13. 102581

14. 111071

15. J200A2

16. 102813

17. J200A28

18. 213542-1112

19. 202021

20. 107261

21. 107331

22. 107291

23. 107281

24. 102531-4

25. 102961

26. 107311

27. J2008113

28. MS3102E10SL4P

29. AN936A4

30. AN515C4-5

31. MS20995C41

MV-74V CONTROL VALVE (EO-1) (MAROTTA VALVE CORP. 218.261)

(A) (B) (C) (D)

ADJUSTING SCREW

NUT (E)

LOCKING SLUG (F)

LOCKWIRE SCREW

LOCKWIRE (G)

POPPET RETURN SPRING

SLEEVE AND SEAT PREFORMED PACKING (O-RING) (H) (I)

RETAINING SLEEVE (J)

BACKUP WASHER

STEM PREFORMED PACKING (O-RING) (K) (L)

SEAT ASSEMBLY (M)

STEM (N)

CAGE (O)

CORE SCREW (2 PLACES)

CORE PREFORMED PACKING (O-RING) (2 PLACES) (P) (Q)

BODY

COVER PREFORMED PACKING (O-RING) (R) (S)

COIL AND CORE ASSEMBLY

ARMATURE ASSEMBLY

NUT LOCK

FLAT WASHER

LOCKWIRE SCREW

NUT (T)

COIL COVER

SCREW

RECEPTACLE INSULATOR

SEAL PREFORMED PACKING (O-RING) (U) (V)

ELECTRICAL RECEPTACLE (HENDIN PART 10-09213) (W)

WASHER (4 PLACES)

SCREW (4 PLACES)

LOCKWIRE (X)

DRAWN BY:	<i>[Signature]</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30128	REVISION DATE OF THIS PAGE
PLANNER:	<i>[Signature]</i>		EO's - 1	
WRITER:	<i>[Signature]</i>			28 Aug 1962
APPROVED BY:	<i>[Signature]</i>		ART CONTROL NO. M-ME-MP1-2000-598-B	

MSFC - Form 1151-1 (June 1961)

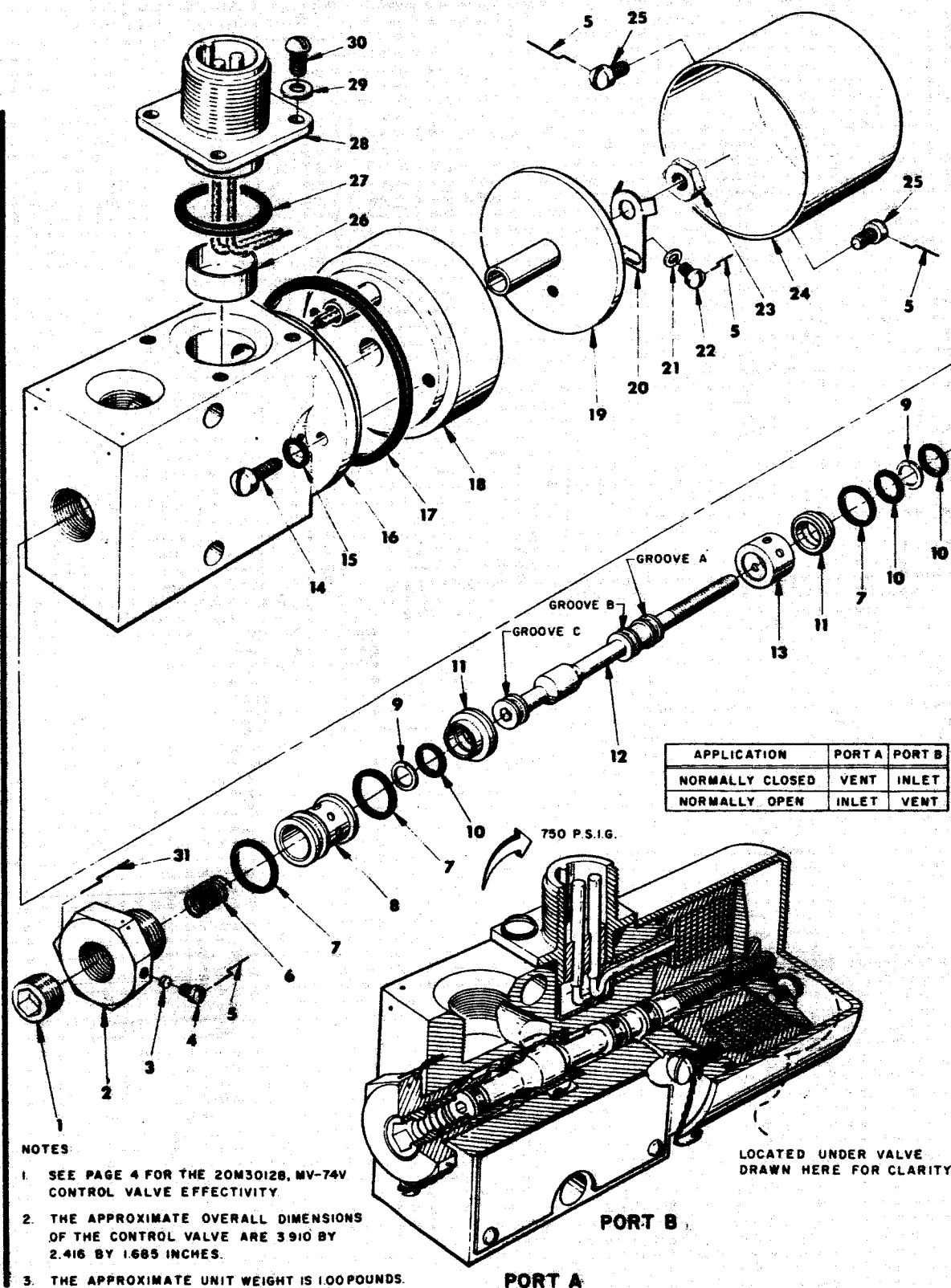
MANUFACTURING PLAN

PROJECT LIFE

MP1-2000

PAGE

3 OF 4



NOTES

1. SEE PAGE 4 FOR THE 20M30128, MV-74V CONTROL VALVE EFFECTIVITY
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE CONTROL VALVE ARE 3.910 BY 2.416 BY 1.685 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 100 POUNDS.

REVISION DATE

28 AUG. 1962

M-ME-2000-598A

20M30128

II.12.1.3

Page 7 of 8

MANUFACTURING PLAN

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.3 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 100 g's in each of the three major axes:
- 10-milliseconds duration - triangular wave, or
 - 8-milliseconds duration - sine wave, or
 - 6-milliseconds duration - square wave.

- 1.4 Vibration Withstanding Capability. The valve is designed to withstand, without damage or excessive leakage, while pressurized to 750 p.s.i.g., vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:
- 20 to 55 c.p.s. at 10 g's,
 - 55 to 110 c.p.s. at 0.06-inch double amplitude displacement, and
 - 110 to 2,000 c.p.s. at 40 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve is outlined in Performance Specification 10M01374 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-C-5015
 MIL-E-5272
 MIL-L-25567
 MIL-Q-9858
 NASA - MSFC-SPEC-164
 MSFC-PROC-158

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-202
 MIL-STD-643
 MS33586
 MS33653
 Army Ballistic Missile Agency
 ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302
 10509303
 10509311
 10M01374

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	EO-1
SA-6	EO-1
SA-7	EO-1
SA-8	EO-1
SA-9	EO-1
SA-10	EO-1
Spares	Before installing modify to latest configuration

20M30128

REVISION DATE

20 JUL 1962

SUMMARY SHEET	
Nomenclature ---Valve (LOX-Replenishing)	
Drawing Numbers: 10414003, 20M30045	Vendor: Hydromatics Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $8170 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 18 Total Number of Failures Reported: 7	MCBF (in cycles): 122.4 Total Cycles of Operation: 857 Vehicle Equipment: X Ground Equipment:

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>6</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish <u>1</u> Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-7 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valve (LOX Replenishing)	
Drawing Numbers: 10414003	Vendor: Hydromatics Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy	
Failure Rate: $6622 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 151
Number of Components this Data Represents: 11	Total Cycles of Operation: 455
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature: (normally) 72 to 76°F	
Thermal Shock:	
Shock Impact (Flat Drop): 6 shocks for 35 g, 6 milliseconds	
Leakage Rate: No leakage allowed at 150 psig	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: 5 g at 20-55 cps, 20 g at 110-2000 cps, 0.03 in. D.A. at 55-110 cps	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	
<u>2</u>	Burned Out		Indicator Shows:	
	Erratic		No Open	
	Foreign Material		No Close	
	Frozen		Mechanical:	
	Improper Seating		Binding:	
	Intermittent		Broken/Cracked:	
	Inoperative		Broken/Ruptured:	
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh	
	Noisy		Bearing:	
	Over Heated		Pins/Connections Shorted:	
	Operation Sluggish		Other: _____	
	<u>1</u>		Out of Specs	_____
	Oil/Moisture Saturation		_____	
	Sticking		_____	
	Would Not Open			
	Would Not Close			
	Pressure:			
	None			
Low				
High				
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports				
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)				
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report IN-P&VE-E-62-5, January 21, 1962				

Additional information concerning the 10414003 component:

Three failures were reported on the Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414003 LOX REPLENISHING VALVE ASSEMBLY	DATE 15 June 1962 APPROVED <i>[Signature]</i>	PROCEDURE EP-140 PAGE 1 of 4

1. DESCRIPTION.

The LOX replenishing valve assembly 10414003 is a normally closed, pneumatically operated, double acting, ball type, shutoff valve. The valve assembly is a component of the LOX replenishing system. The valve assembly is used to complement the LOX fill and drain valve assembly 10414002. LOX is added or drained from the container to adjust the LOX weight in proportion to fuel density changes as directed by the ground computer. The valve assembly is controlled by two MV-74V control valves 10414027 - one normally open; the other normally closed. The valve assembly is located on the aft bulkhead of container LC as shown in the installation view. The various functional characteristics of the valve assembly are as follows:

1.1 Mechanical Performance Characteristics. The valve assembly is capable of performing mechanically as follows:

- a. Flow chamber operating media: LOX
- b. Drain flow operating pressure: 50 to 150 p.s.i.g.
- c. Fill flow operating pressure: 50 p.s.i.g.
- d. Flow chamber operating proof pressure: 225 p.s.i.g.
- e. Flow chamber burst pressure (without bursting): 375 p.s.i.g.
(CAUTION: Use only for destructive acceptance testing.)
- f. Flow chamber leakage: 40 s.c.i.m. maximum past the main seat when pressurized to 150 p.s.i.g. with GOX or GN₂. No liquid leakage is allowed past the main seat when pressurized to 150 p.s.i.g. with LOX or LN₂.
- g. External leakage allowed: None.
- h. Leakage past the shaft lip seal: 10 s.c.i.m. maximum leakage when the inlet port of the flow chamber is pressurized to 50 ±1 p.s.i.g. with pneumatic pressure.
- i. Flow chamber gate operating time (fully open to fully closed or vice versa): 500 milliseconds (maximum).
- j. Control chamber operating media: Air, helium, or gaseous nitrogen.
- k. Control chamber operating pressure: 500 p.s.i.g. minimum
- l. Control chamber nominal operating pressure: 750 p.s.i.g.
- m. Control chamber proof pressure: 1,125 p.s.i.g.
- n. Control chamber burst pressure (without bursting): 1,875 p.s.i.g.
(CAUTION: Use only for destructive acceptance testing).
- o. Control chamber leakage: 5 s.c.i.m. maximum with 750 p.s.i.g. internal pneumatic pressure.
- p. Operating temperature range: -320° to +100° F.

1.2 Electrical Performance Characteristics. The valve assembly is capable of performing electrically as follows:

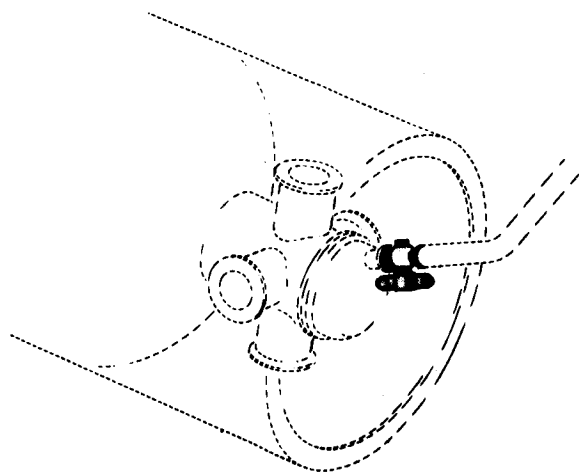
- a. Nominal operating voltage: 28 ±2 v.d.c. with an inductance of 3 a., peak current of 15 a., and resistance of 4 ohms.
- b. Indicator switches: Indicate fully opened and fully closed positions (when one switch is open the other will be closed).
- c. Indicator switch #1 or #2 circuit continuity resistance: 1.0 ohm maximum.

(Continued on page 4)

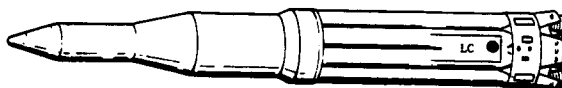
REVISION DATE

10414003

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
PAGE 2 OF 4		PROCEDURE EP-140		MANUFACTURING PLAN	



INSTALLATION VIEW - LOOKING FORWARD



GENERAL LOCATION

LEGEND

10414003 LOX REPLENISHING VALVE ASSEMBLY
("C" REV. & EQ-2) (HYDROMATICS, INC.,
131K6) A B C D E

NOTES

- A IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- B STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- C CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- D OR APPROVED EQUIVALENT.
- E CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.

DRAWN BY:	<i>B. Dennis</i>	ENGINEERING DRAWING RELEASE C	REVISION TO:	10414003	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. L. Bennett</i>		EO'S	-2	
WRITER:	<i>W. W. Franklin</i>		ART CONTROL NO.	M-ME-EP140-787	
APPROVED BY:	<i>M. Hightower</i>				

MANUFACTURING PLAN

PROCEDURE

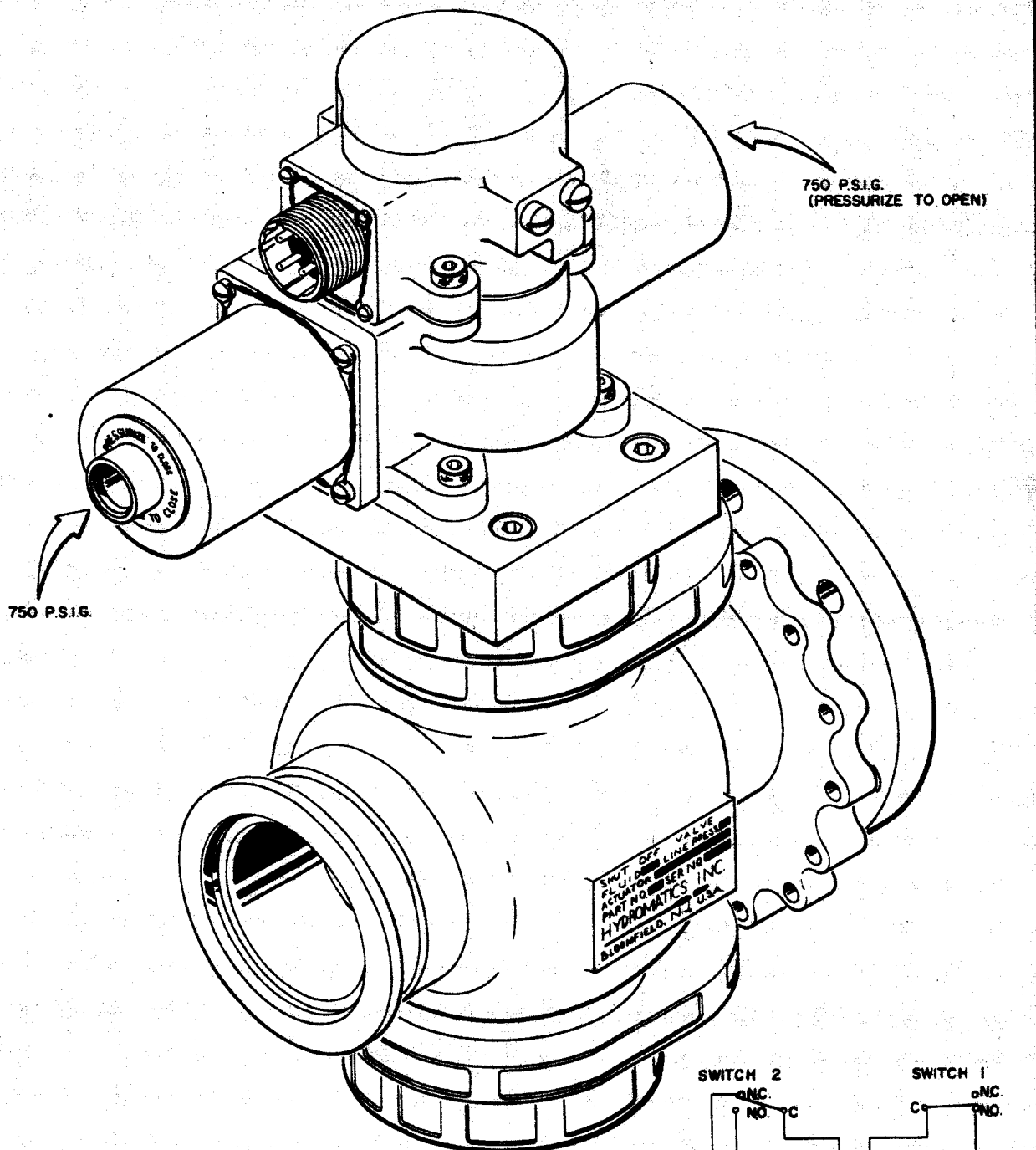
EP-140

PAGE

3

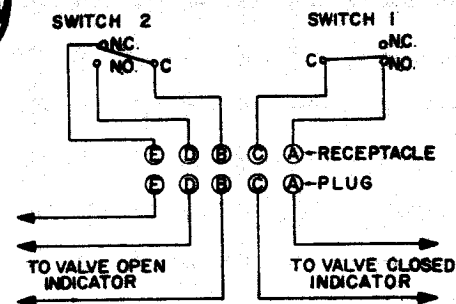
OF

4



NOTES:

1. SEE PAGE 4 FOR THE 10414003 LOX REPLENISHING VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 11.13 BY 6.81 BY 4.44 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 11.00 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

WIRING DIAGRAM
(SHOWN IN VALVE CLOSED POSITION)

REVISION DATE

M-ME-EP140-707

10414003

d. Insulation resistance: 50 megohms minimum with 500 v.d.c. applied between mutually insulated terminals and between each connector terminal and the valve body.

e. The switch wiring diagrams are shown on page 3.

- 1.3 Life Cycle. The valve assembly is capable of operating 2,000 cycles without damage or impairment of performance.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 3.0 g's,
55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance test and the preparation for delivery of the valve assembly are outlined in Performance Specification 10419913 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 MIL-Q-9858
NASA - MSFC-SPEC-106

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-643
 MS33586
Army Ballistics Missile Agency
 ABMA-STD-29

3.3 Drawings:

Ordnance Corps - 10414003
 10419909
 10419913
 10509300
 10509302
 10509305
 10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"C" Rev.
SA-1	"C" Rev.
SA-2	"C" Rev. and EO-2
SA-3	"C" Rev. and EO-2
SA-4	"C" Rev. and EO-2
SPARES	Before installing modify to latest configuration

10414003

REVISION DATE

DATA SHEET	
Nomenclature: Valve (LOX Replenishing)	
Drawing Numbers: 20M30045	Vendor: Hydromatics Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: 9950 x 10 ⁻⁶ /cy.	MCBF (in cycles): 100.5
Number of Components this Data Represents: 7	Total Cycles of Operation: 402
Number of Failures Reported: 4	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as shown on page 3, II.13.1	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>4</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
Low			
High			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 and SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30045 valve:

Four failures were reported on the Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 14 November 1962
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30045 LOX REPLENISHING VALVE ASSEMBLY		PROCEDURE MP1-2000
APPROVED <i>A. Lacy</i>		PAGE 1 OF 4

1. DESCRIPTION.

The LOX replenishing valve assembly 20M30045 is a pneumatically operated, double acting, ball type, shutoff valve. The valve assembly is a component of the LOX replenishing system. The valve assembly is used to complement the fill and drain LOX ball rotor shutoff valve 20M30042. LOX is added or drained from the container to adjust the LOX weight in proportion to fuel density changes as directed by the ground computer. To open the valve assembly, a ground pressure source is supplied through the 1/4-inch quick disconnect coupling nipple 20M30390 in the fin IV quick release plate assembly 75M02768. To close the valve assembly, the GN₂ control pressure system, normally open, 20M30128 MV-74V control valve in the rear skirt of container F2 is energized. The valve assembly is located in the rear skirt of container L4 as shown in the installation view. The various functional characteristics of the valve assembly are as follows:

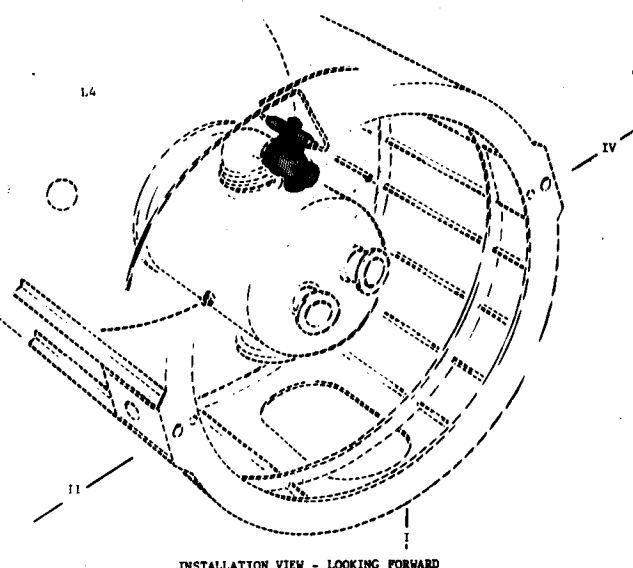
1.1 Mechanical Performance Characteristics. The valve assembly is capable of performing mechanically as follows:

- a. Flow chamber operating media: Liquid oxygen or liquid nitrogen.
- b. Flow chamber operating pressure: 150 p.s.i.g. minimum internal pressure.
- c. Flow chamber proof operating pressure: 225 p.s.i.g. minimum internal pressure.
- d. Flow chamber burst pressure (without bursting): 375 p.s.i.g. minimum internal pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Switch to switch flow chamber gate operating time (to open or to close): 500 milliseconds maximum.
- f. Leakage allowed past either control piston assembly seal with 750 ± 10 p.s.i.g. pneumatic pressure applied: 5 s.c.i.m. maximum.
- g. External leakage allowed from the control piston assembly: None except from the vent port.
- h. Leakage allowed into the switch housing when either control piston assembly is pressurized to 750 ± 10 p.s.i.g.: None.
- i. Leakage allowed past the flow chamber gate seal with a minimum of 50 ± 1 p.s.i.g. applied to the inlet port of the flow chamber: 40 s.c.i.m. maximum when pressurized pneumatically; no liquid leakage when pressurized with liquid nitrogen.
- j. Leakage allowed past the flow chamber gate seal with a minimum of 150 p.s.i.g. applied to the outlet port of the flow chamber: 40 s.c.i.m. maximum when pressurized pneumatically; no liquid leakage when pressurized with liquid nitrogen.
- k. Leakage allowed past the shaft lip seal with 50 ± 1 p.s.i.g. applied to the inlet port: 10 s.c.i.m. maximum when pressurized pneumatically; no liquid leakage when pressurized with liquid nitrogen.
- l. External leakage allowed when the flow chamber is pressurized pneumatically or with liquid nitrogen: None.
- m. Control chamber operating media: Air, helium, or gaseous nitrogen.
- n. Minimum control chamber operating pressure: 500 p.s.i.g. pneumatic pressure.

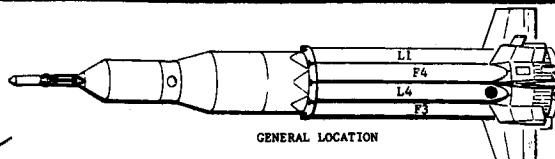
REVISION DATE

(Continued on page 4)

20M30045

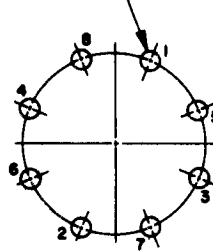
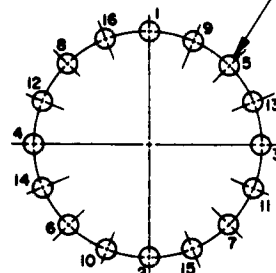


INSTALLATION VIEW - LOOKING FORWARD



GENERAL LOCATION

TIGHTEN SCREWS IN THE ORDER SHOWN TO 35 IN.-LBS. THEN REPEAT TO 45 IN.-LBS.

DETAIL A - TYPICAL SCREW PATTERN
FOR ITEMS 3 AND 35DETAIL B - TYPICAL SCREW PATTERN
FOR ITEM 18

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
- (B) ALL MATERIALS WITHIN THE FLOW CHAMBER OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH MSFC-STD-105.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) OR APPROVED EQUIVALENT.
- (G) TORQUE INITIALLY TO 35 INCH-POUNDS IN THE SEQUENCE SHOWN IN DETAIL A. THEN TORQUE TO 45 INCH-POUNDS IN THE SAME SEQUENCE.
- (H) LUBRICATE WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE Z POWDER OR APPROVED EQUIVALENT.
- (J) TORQUE INITIALLY TO 35 INCH-POUNDS IN THE SEQUENCE SHOWN IN DETAIL B. THEN TORQUE TO 45 INCH-POUNDS IN THE SAME SEQUENCE.
- (K) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (L) TORQUE 70 TO 120 INCH-POUNDS.
- (M) TORQUE 50 TO 70 INCH-POUNDS.
- (N) LUBRICATE WITH DOW-CORNING CORP. GREASE DC-2-0026 OR APPROVED EQUIVALENT.
- (P) TORQUE 10 TO 13 INCH-POUNDS.
- (Q) INSTALL WITH THE INDEXING KEY IN THE POSITION SHOWN.
- (R) TORQUE 7 TO 9 INCH-POUNDS.

LEGEND

20M30045

LOX REPLENISHING VALVE ASSEMBLY
(HYDROMATICS INC., 70 OWNER PARKWAY,
LIVINGSTON, N. J., PART 131K13) (A)

131K13

150 P.S.I. LOW TEMPERATURE PRESSURE
OPERATED 2-INCH SHUTOFF VALVE
SOCKET HEAD SET SCREW (8 PLACES) (C)
SPACER (8 PLACES)
BOTTOM BEARING RETAINER
GASKET SEAL (H)
SET SCREW
LOCKING INSERT (HELI-COIL) (F)
BOTTOM BEARING SLEEVE
SPACER
BEARING OUTER RACE (H)

1. #10-32-7/8
2. 19HM002
3. 58MA013
4. 33LS001
5. 350H002
6. 3585-6CNU-9/16
7. 17BA003
8. 19JK001
9. 39JP001

10. 350P001
11. 39CP002
12.
13. 3591-3CNU-0.285
14. #00-1/8
15. 510E317
16. #10-32-7/8
17. 19BM002
18. 12KB003
19. 23L0008
20. 10KA002
21. 3591-3CNU-0.285
22. 11KB006
23. 17FA003
24. 32BH002
25. 26ES002
26. 26EX002
27. 13PC001
28. 18FX004
29. 18FA001
30. SSR12
31. 36HH001
32. MS20995C20-4
33. AN814-4CL
34. 76NA904
35. 58MA031
36. 3591-4CNU-3/8
37. 41HW001
38. 42-ND-24-048
39. 1/4-28-3/4
40. 29GT002
41. 1/4-28-1
42. 76NA023
43. 12N12-D
44. 13PG003
45. 8N8-D
46. 76NA010
47. 3591-4CNU-1/4
48. 1/4-28-1
49. 28KB005
50. 47200
51. 3591-3CNU-0.285
52. 76NA220
53. 14JC001
54. 16BP001
55. 15HG001
56. 40GD001
57. 16BP002
58. 34AA008
59. #10-32-5/8
60. 510E012
61. 510E011
62. 3585-2CNU-0.246
63. 240P001
64. 2400E35
65. MS3102R-14S-5P
66. #8-32-3/8
- ROLLER BEARING (38 PLACES) (H)
BEARING INNER RACE (H)
BALL (5/16 INCH DIAMETER) (H)
LOCKING INSERT (HELI-COIL) (8 PLACES) (F)
U-ROUND HEAD DRIVE SCREW (4 PLACES)
NAMEPLATE
SOCKET HEAD SET SCREW (16 PLACES) (J)
SPACER (16 PLACES)
FLANGE
SEAT ASSEMBLY
BALL (H)
LOCKING INSERT (HELI-COIL) (16 PLACES) (F)
BODY
TOP BEARING SLEEVE
SHAFT SPRING
SHAFT LIPSEAL
SHAFT LIPSEAL
SHAFT (H)
WASHER
WASHER SEAL
BALL BEARING
BONNET RING
LOCKWIRE (K)
PLUG AND BLEEDER (L)
PREFORMED PACKING (O-RING) (F) (H)
SEAL RETAINER
LOCKING INSERT (HELI-COIL) (4 PLACES) (F)
BONNET
SPLINE NUT (2 PLACES)
HEXAGONAL HEAD CAP SCREW (M)
ACTUATOR MOUNTING PLATE
SOCKET HEAD CAP SCREW (4 PLACES) (H)
PREFORMED PACKING (O-RING) (F) (H)
NYLINED BEARING (N)
DRIVE SHAFT (A)
NYLINED BEARING (N)
PREFORMED PACKING (O-RING) (F) (H)
LOCKING INSERT (HELI-COIL) (F)
SOCKET HEAD CAP SCREW (2 PLACES) (M)
ACTUATOR BODY
RELIEF FITTING (ALUMITE - 1 TO 5 P.S.I.) (P) (L)
LOCKING INSERT (HELI-COIL) (4 PLACES) (F)
PREFORMED PACKING (O-RING) (F) (N)
ACTUATOR PISTON (N)
LINK PIN (N)
LINK (N)
BELL CRANK (N)
BELL CRANK PIN (N)
FITTING
SOCKET HEAD CAP SCREW (4 PLACES) (P)
NAMEPLATE (PRESSURIZE TO CLOSE)
NAMEPLATE (PRESSURIZE TO OPEN)
LOCKING INSERT (HELI-COIL) (4 PLACES)
GASKET
SWITCH ASSEMBLY
ELECTRICAL CONNECTOR (Q)
SOCKET HEAD CAP SCREW (4 PLACES) (R)

DRAWN BY:

PLANNER:

WRITER:

APPROVED BY:

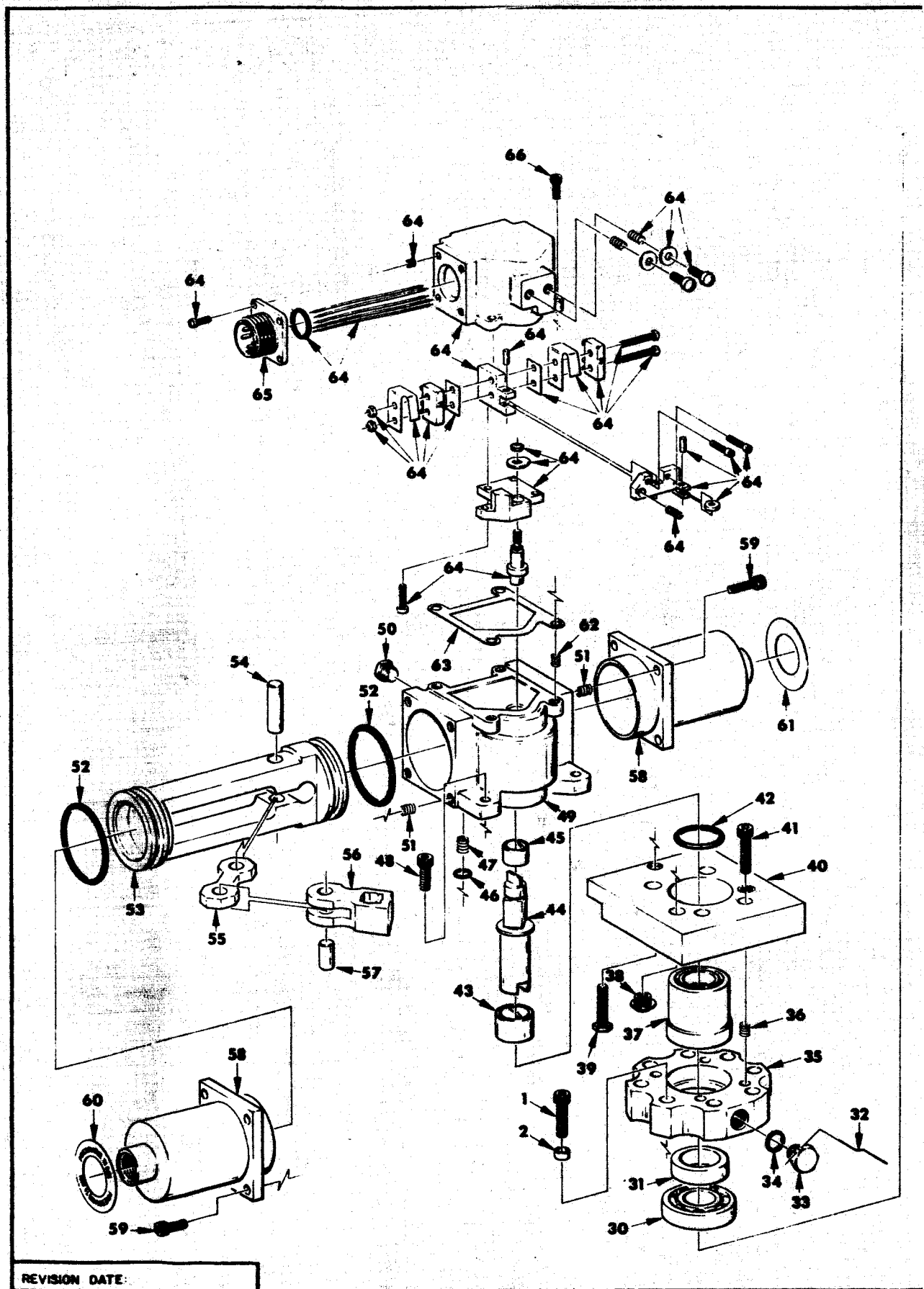
ENGINEERING
DRAWING
RELEASE

REVISION TO: 20M30045

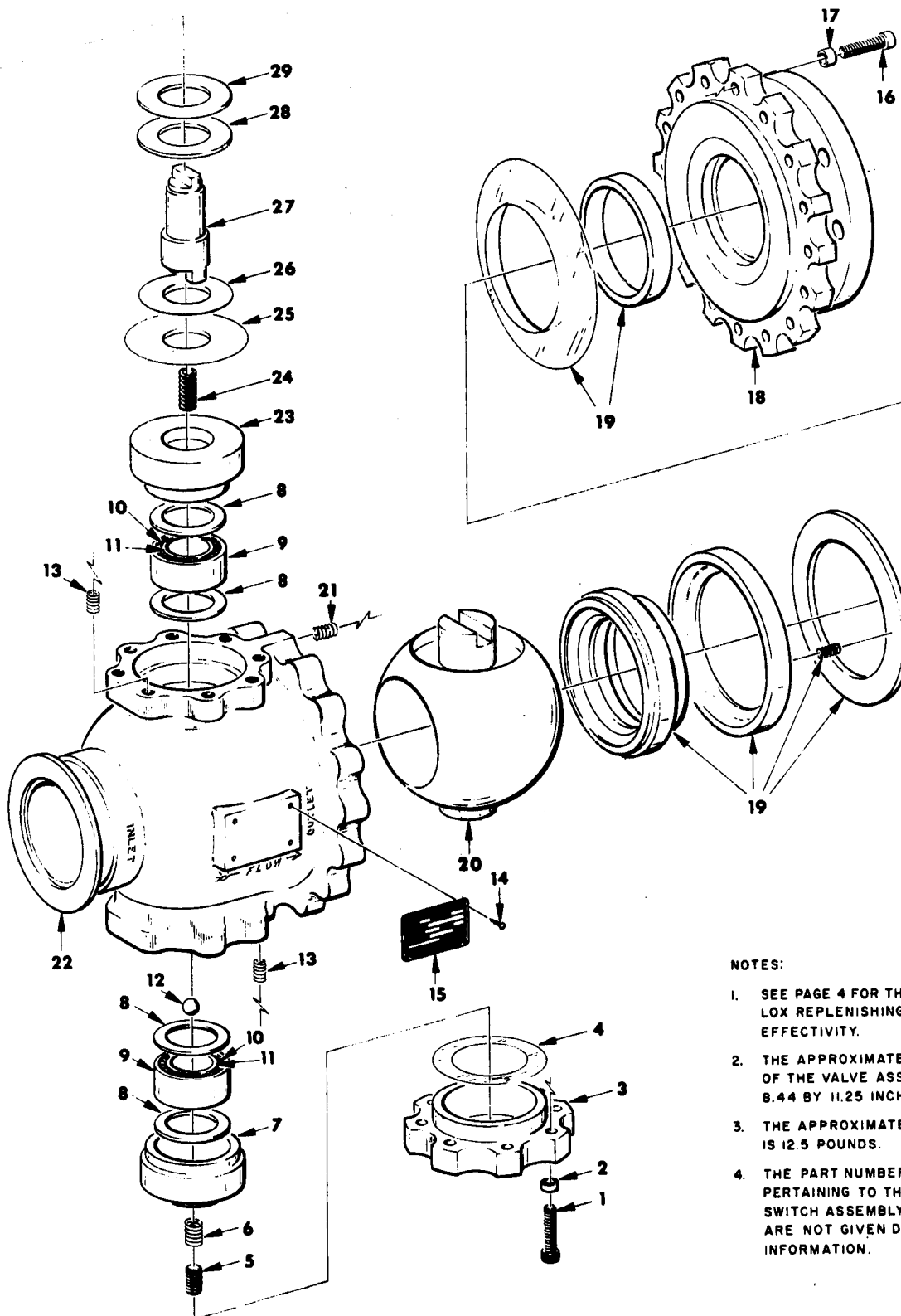
EO's

ART CONTROL NO. M-ME-E-1025

REVISION
DATE OF
THIS PAGE



REVISION DATE:



750

NOTES:

1. SEE PAGE 4 FOR THE 20M30045 LOX REPLENISHING VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 5.13 BY 8.44 BY 11.25 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 12.5 POUNDS.
4. THE PART NUMBER AND NOMENCLATURE PERTAINING TO THE COMPONENTS OF SWITCH ASSEMBLY 2400E35 (ITEMS 64) ARE NOT GIVEN DUE TO LACK OF INFORMATION.

MANUFACTURING PLAN

PROCEDURE

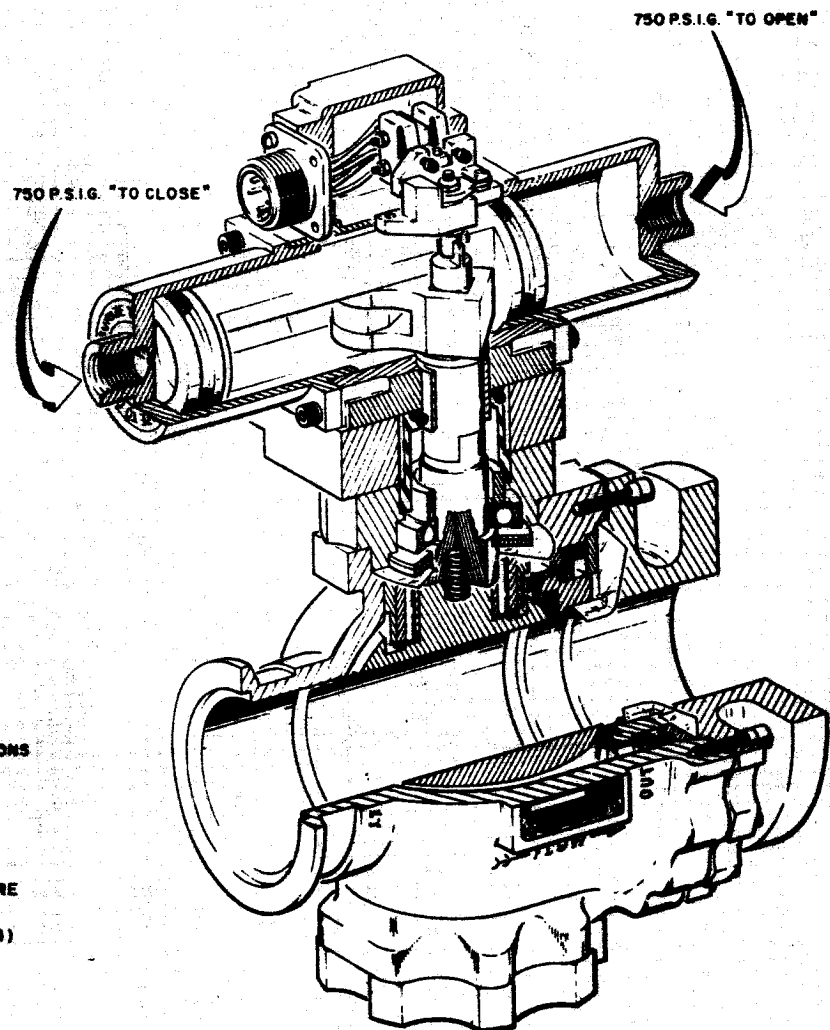
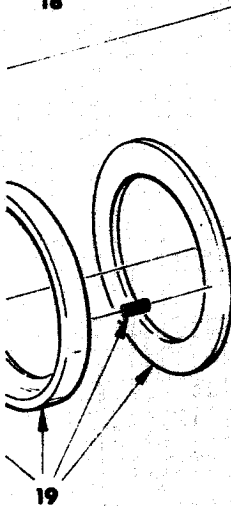
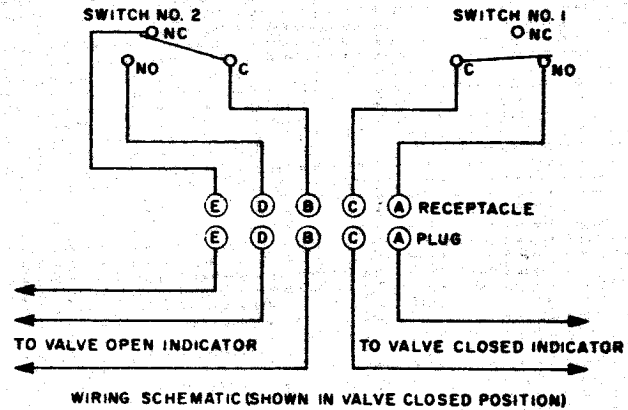
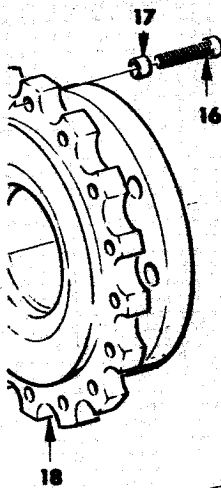
MP1-2000

PAGE

3

OF

4



NOTES:

1. SEE PAGE 4 FOR THE 20M30045 LOX REPLENISHING VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 8.13 BY 8.44 BY 11.25 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 12.5 POUNDS.
4. THE PART NUMBER AND NOMENCLATURE PERTAINING TO THE COMPONENTS OF SWITCH ASSEMBLY 2400E35 (ITEMS 64) ARE NOT GIVEN DUE TO LACK OF INFORMATION.

M-ME-E-1025

20M30045

- o. Control chamber nominal operating pressure: 750 p.s.i.g. pneumatic pressure.
- p. Control chamber proof operating pressure: 1,125 p.s.i.g. minimum pneumatic pressure.
- q. Control chamber burst pressure (without bursting): 1,875 p.s.i.g. minimum. (CAUTION: Use only for destructive acceptance testing.)
- r. Operating temperature range: -320° to +160° F.

1.2 Electrical Performance Characteristics. The valve assembly is capable of performing electrically as follows:

- a. Operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal.
- b. Insulation resistance: 50 megohms minimum with 500 v.d.c. applied between mutually insulated connector terminals or between each connector terminal and the valve body.
- c. Contact resistance of the fully closed contacts of the subminiature switches: 0.5 ohm maximum.
- d. Current loading capabilities of the subminiature switches:
Inductive - 3 a.; resistive - 4 a.; and peak current - 15 a.
- e. The switch wiring diagrams are shown on page 3.
- f. Switch indications required for the flow control gate fully open, intermediate, and fully closed positions: Gate fully closed position - switch 1 must indicate a closed circuit between electrical connector pins "A" and "C"; switch 2 must indicate a closed circuit between electrical connector pins "B" and "E" and an open circuit between pins "B" and "D". Gate intermediate position - switch 1 must indicate an open circuit between electrical connector pins "A" and "C"; switch 2 must indicate a closed circuit between electrical connector pins "B" and "E" and an open circuit between pins "B" and "D". Gate fully open position - switch 1 must indicate an open circuit between electrical connector pins "A" and "C"; switch 2 must indicate an open circuit between electrical connector pins "B" and "E" and a closed circuit between pins "B" and "D".

1.3 Life Cycle. The valve assembly is capable of operating 2,000 cycles without damage or impairment of performance.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

1.4 Shock Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes with temperature stabilized at LN₂ temperature and the outlet port pressurized to 150 p.s.i.g.:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions with temperature stabilized at LN₂ temperature:
- 20 to 55 c.p.s. at 3.0 g's,
 - 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 - 100 to 2,000 c.p.s. at 10.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance test and the preparation for delivery of the valve assembly are outlined in Performance Specification 10M01069 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858
MIL-W-5086
NASA - MSFC-SPEC-106
MSFC-PROC-158
MSFC-SPEC-164

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33586
Army Ballistic Missile
Agency - ABMA-STD-18
NASA - MSFC-STD-105

3.3 Drawings:

Ordnance Corps - 10509302
10509303
MSFC - 10419909
10M01069

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	
SA-6	
SA-7	
SA-8	
SA-9	
SA-10	
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30045

REVISION DATE

MSFC - Form 1151-1 (June 1961)

II.13.1

Page 21 of 21

DATA SHEET	
Nomenclature: Valve and Orifice Assembly (Helium)	
Drawing Numbers: 10414091	Vendor: W.O. Leonard Inc. Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 1,964 x 10 ⁻⁶ /cy.	MCEF (in cycles): 509
Number of Components this Data Represents: 12	Total Cycles of Operation: 1,018
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965 (Revision)

II.14.1.1
Page 1 of 8

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>2</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ <u>Particle count</u> <u>exceeds specs.</u>
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2, SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 10414091 component:

The two failures were reported on Inspection Reports.

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MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		PROCEDURE NO.
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414091 VALVE AND ORIFICE ASSEMBLY	DATE 16 August 1961 APPROVED 	EP-140 PAGE 1 OF 4

1. DESCRIPTION.

The valve and orifice assembly 10414091 is a component of the helium pressurization system. The assembly consists of a MV-74V control valve 10414027 and a constant flow regulator valve assembly 10414089 on SA-T, -1, and -2 and 20M30120 on SA-3 and -4. The valve and orifice assembly is used to control the flow rate of helium into the LOX and fuel propellant utilization systems. When the solenoid in the control valve is energized the flow of helium is allowed to bypass the regulator valve assembly and flow through the propellant utilization bypass orifice 10414259. The solenoid is energized from a pre-determined time until 5 seconds after liftoff to permit a greater flow of helium for purging the propellant utilization tube assemblies. The valve and orifice assembly is located in the forward skirt of containers F2 and L4 as shown in the installation view. The various functional characteristics of the MV-74V control valve are as follows:

1.1 Pneumatic Operating Characteristics. The control valve is capable of operating pneumatically as follows:

- a. Operating media: Air, gaseous nitrogen, or helium.
- b. Leakage through vent port: 5 s.c.i.m. maximum with an internal pneumatic pressure of 750 ± 10 p.s.i.g. applied to the inlet port throughout the operating temperature range.
- c. Operating temperature range: Minus 65° to 165° F.
- d. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure without leakage in excess of 2 standard cubic centimeters per hour from the body or body vent while in the opened or closed position.
- e. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure.
- f. Burst pressure (without bursting): 1,875 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- g. Flow capacity equivalent: A sharp-edged orifice of 0.110-inch diameter with 750 ± 10 p.s.i.g. pneumatic pressure applied.

1.2 Electrical Performance Characteristics. The electrical performance characteristics of the control valve are as follows:

- a. Solenoid voltage endurance: 28 ± 1.5 v.d.c. applied to the coil continuously for 24 hours.
- b. Insulation resistance: 50 megohms minimum between pin "A" and the valve body and pin "B" and the valve body.
- c. Operating current for continuous solenoid operation: 1.2 amperes when energized with a 24 ± 0.5 v.d.c. power supply.
- d. Solenoid operating voltage: Actuation - 10 to 18 v.d.c.
Deactuation - 10 to 1.0 v.d.c.

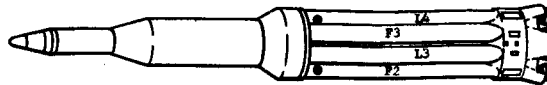
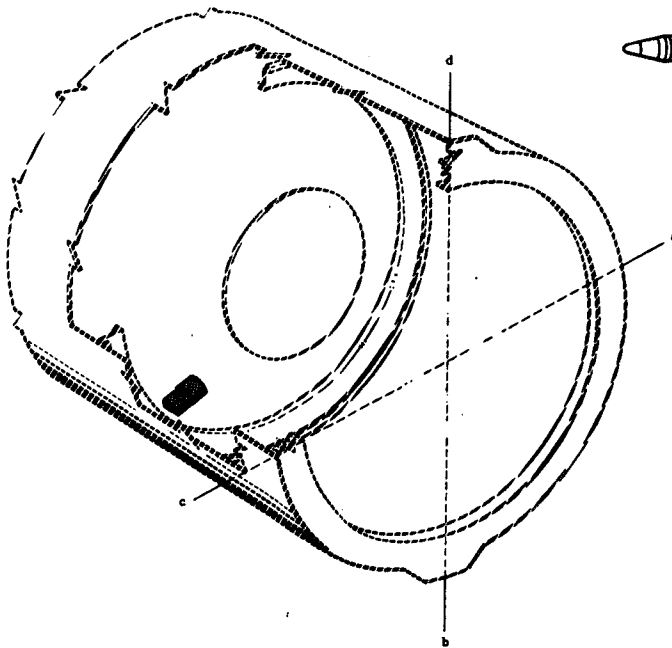
CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 80 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave

(Continued on Page 4)

REVISION DATE 3 NOV 66 10414091



GENERAL LOCATION

INSTALLATION VIEW - LOOKING APT
(TYPICAL ON CONTAINERS F2 & 1A)

== NOTES ==

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) OR APPROVED EQUIVALENT.
- (E) SEE EP-140 WRITEUP ON 10414089 OR 20M30120 FOR PERTINENT NOTES AND EXPLODED VIEW.
- (F) TORQUE 70 TO 120 INCH-POUNDS.
- (G) LUBRICATE WITH DOW-CORNING CORP. QC-2-0093 OR APPROVED EQUIVALENT.
- (H) TORQUE 135 TO 150 INCH-POUNDS.
- (J) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (K) SEE EP-140 WRITEUP ON 10414027 FOR PERTINENT NOTES AND EXPLODED VIEW.

== LEGEND ==

- 10414091 VALVE AND ORIFICE ASSEMBLY ("B" REV. & EO-4A) (A) (B) (C)
- 1. *10414089 LOW CONSTANT FLOW REGULATOR VALVE ASSEMBLY (WALLACE O. LEONARD INC. 156040-3) (D) (E) (F) (D) (G)
- 2. MS28778-4 PREFORMED PACKING (O-RING) (H) (G)
- 3. 10414270 ADAPTER (H)
- 4. 10414259 PROPELLANT UTILIZATION BYPASS ORIFICE (H)
- 5. MS20995C41 LOCKWIRE (J)
- 6. 10414027 MV-74V CONTROL VALVE ("D" REV., EO-6, -7, & -8) (MAROTTA VALVE CORP. 218263) (K)

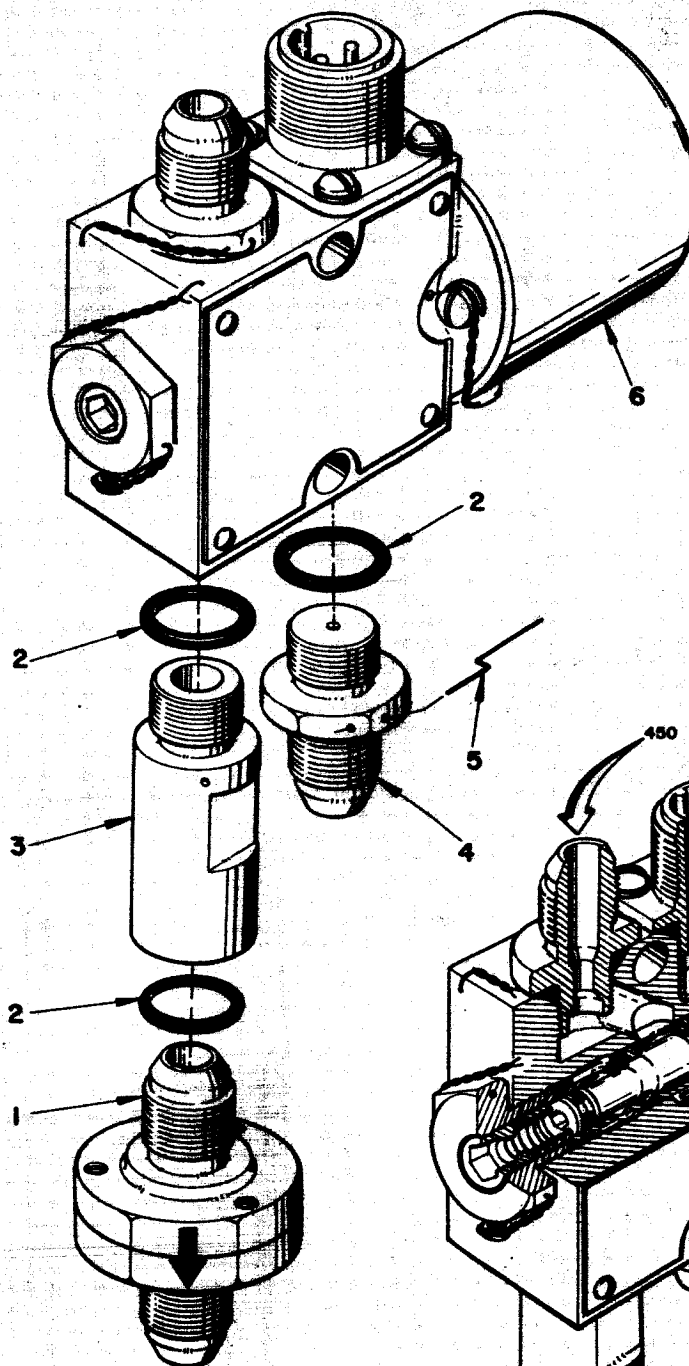
*THIS ITEM IS REPLACED BY 20M30120 CONSTANT FLOW REGULATOR VALVE (WALLACE O. LEONARD INC., 156070-2) FOR USE ON SA-3 AND -4 ONLY.

DRAWN BY:	<i>H. Bates</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414091	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. C. Bennett</i>	B	EO's -4A	3 Nov 1961
WRITER:	<i>G. L. Schenck</i>			
APPROVED BY:	<i>M. Schuster</i>		CONTROL NO. M-F&AE-EP140-465-A	

MANUFACTURING PLAN

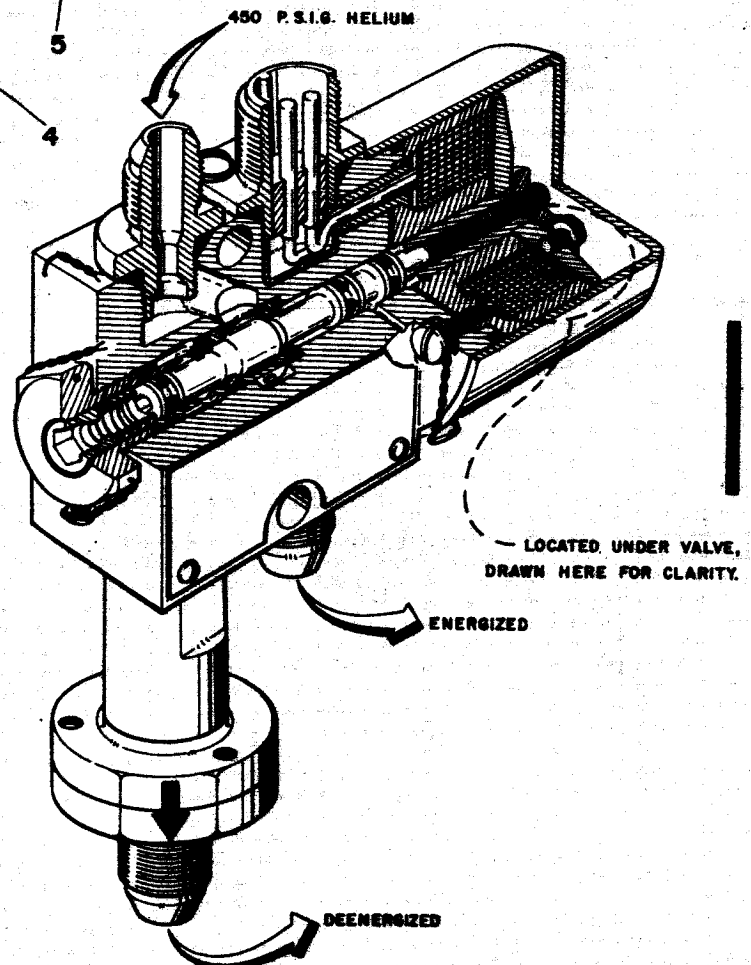
PROCEDURE EP-140

PAGE 3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 10414091 VALVE AND ORIFICE ASSEMBLY EFFECTIVITY.
2. FOR EXPLODED VIEW OF THE MV-74V CONTROL VALVE 10414027 SEE THE EP-140 WRITEUP ON 10414027.
3. FOR EXPLODED VIEW OF THE 10414089 LOW CONSTANT FLOW REGULATOR VALVE ASSEMBLY SEE THE EP-140 WRITEUP ON 10414089.
4. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE AND ORIFICE ASSEMBLY ARE 4.80 BY 3.910 BY 1.685 INCHES.
5. THE APPROXIMATE UNIT WEIGHT IS 1.30 POUNDS.



REVISION DATE 3 NOV. 1961

1AE-EP 140-406-A

10414091

MSFC - Form 1251-2 (June 1961)

- 1.4 Vibration Withstanding Capability. The valve is designed to withstand, without damage or excessive leakage while pressurized to 750 p.s.i.g., vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 10 g's,
 55 to 110 c.p.s. at 0.06-inch double amplitude displacement, and
 110 to 2,000 c.p.s. at 40 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the MV-74V control valve is outlined in Performance Specification 10419927 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-C-5015
 MIL-E-5272
 MIL-L-25567
 MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-202
 MIL-STD-643
 MS33586
 MS33653
 Army Ballistic Missile Agency
 ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10419909
 10509300
 10509302
 10509305
 10509311

*EFFECTIVITY OF 10414091

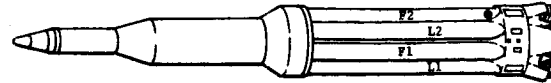
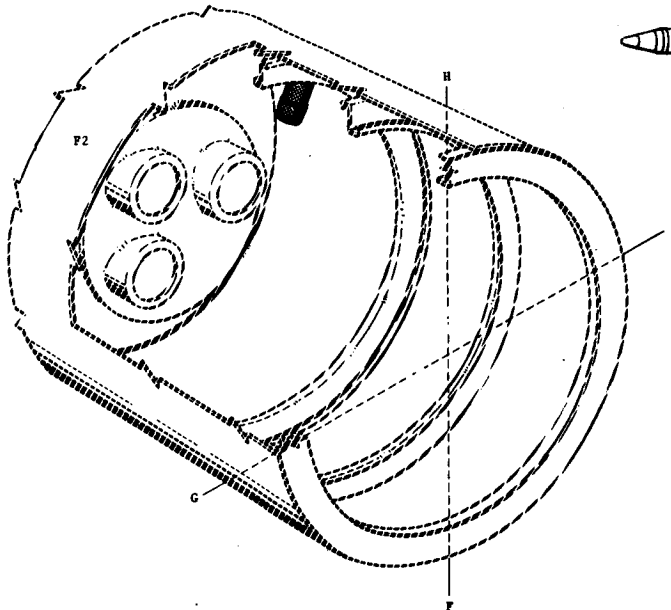
VEHICLE	REVISIONS
SA-T	"B" Rev., and EO-4A
SA-1	"B" Rev., and EO-4A
SA-2	"B" Rev., and EO-4A
SA-3	"B" Rev., and EO-4A
SA-4	"B" Rev., and EO-4A
Spares	Before installing modify to latest configuration

*For effectivity of the low constant flow regulator valve assembly and the MV-74V control valve used in this assembly, see the EP-140 writeup on 10414089 or 20M30120 and 10414027 respectively.

DATA SHEET	
Nomenclature: Valve and Orifice Assy. (Control Pressure)	
Drawing Numbers: 10414355	Vendor: NASA/MSFC
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $2,991 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 7 Number of Failures Reported: 0	MCBF (in cycles): 334.3 Total Cycles of Operation: 463 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: <u>No leakage allowed at 750 psig</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-62-5, January 21, 1962, MSFC			

MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		PROCEDURE NO.
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414355 VALVE AND ORIFICE ASSEMBLY	DATE 17 August 1961	EP-140
APPROVED <i>A. G. [Signature]</i>		PAGE 1 of 4
<p>1. DESCRIPTION.</p> <p>The valve and orifice assembly 10414355 is a component of the control pressure system. The assembly consists of an MV-74V control valve 10414027 and orifice reducer assembly 10414587. The valve and orifice assembly is used in the control pressure system to supply the actuating pressure to the control port of the LOX fill and drain valve assembly 10414002. The three-way, two-position electro-mechanically operated MV-74V control valve is used in its normally closed position. The valve and orifice assembly is energized to open the LOX fill and drain valve assembly during either the LOX container filling or draining operation. The orifice reducer assembly 10414587 is used to restrict the flow through the vent port of the valve and orifice assembly. The valve and orifice assembly is located in the rear skirt of container F2 as shown in the installation view. The various functional characteristics of the MV-74V control valve are as follows:</p> <p>1.1 <u>Pneumatic Operating Characteristics.</u> The control valve is capable of operating pneumatically as follows:</p> <ol style="list-style-type: none"> a. Operating media: Air, gaseous nitrogen, or helium. b. Leakage through vent port: 5 s.c.i.m. maximum with an internal pneumatic pressure of 750 ± 10 p.s.i.g. applied to the inlet port throughout the operating temperature range. c. Operating temperature range: Minus 65° to 165° F. d. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure without leakage in excess of 2 standard cubic centimeters per hour from the body or body vent while in the opened or closed position. e. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure. f. Burst pressure (without bursting): 1,875 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.) g. Flow capacity equivalent: A sharp-edged orifice of 0.110-inch diameter with 750 ± 10 p.s.i.g. pneumatic pressure applied. <p>1.2 <u>Electrical Performance Characteristics.</u> The electrical performance characteristics of the control valve are as follows:</p> <ol style="list-style-type: none"> a. Solenoid voltage endurance: 28 ± 1.5 v.d.c. applied to the coil continuously for 24 hours. b. Insulation resistance: 50 megohms minimum between pin "A" and the valve body and pin "B" and the valve body. c. Operating current for continuous solenoid operation: 1.2 amperes when energized with a 24 ± 0.5 v.d.c. power supply. d. Solenoid operating voltage: Actuation - 10 to 18 v.d.c. Deactuation - 10 to 1.0 v.d.c. <p style="padding-left: 40px;">CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.</p> <p>1.3 <u>Shock Withstanding Capability.</u> The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 80 g's in each of the three major axes:</p> <p style="padding-left: 40px;">10-milliseconds duration - triangular wave, or 8-milliseconds duration - sine wave, or 6-milliseconds duration - square wave.</p>		
(Continued on Page 4)		REVISION DATE 3 NOV. 1961 10414355



GENERAL LOCATION

INSTALLATION VIEW - LOOKING FORWARD

== NOTES ==

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) TORQUE 70 TO 120 INCH-POUNDS.
- (E) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (F) OR APPROVED EQUIVALENT.
- (G) LUBRICATE WITH DOW-CORNING CORP. GREASE D.C. 55 OR APPROVED EQUIVALENT.
- (H) SEE THE EP-140 WRITEUP ON 10414027 FOR PERTINENT NOTES AND EXPLODED VIEW.

== LEGEND ==

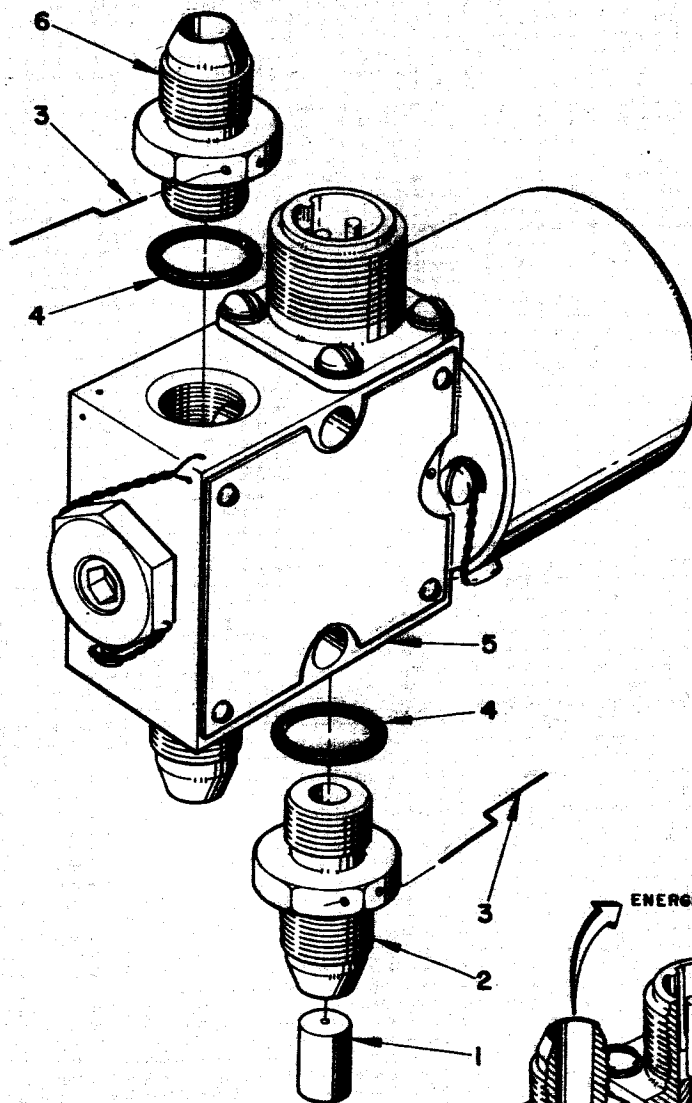
- | | | |
|---------------|--|-------------|
| 10414355 | VALVE AND ORIFICE ASSEMBLY | (A) (B) (C) |
| 10414587 | ORIFICE REDUCER ASSEMBLY | (D) |
| 1. 10414586 | ORIFICE | |
| 2. 10414585 | MODIFIED REDUCER | |
| 3. MS20995C41 | LOCKWIRE | (E) |
| 4. MS28778-4 | PREFORMED PACKING (O-RING) | (F) (G) |
| 5. 10414027 | HV-74V CONTROL VALVE ("D" REV., EO-6, -7, & -8) (MAROTTA VALVE CORP. 218263) | (H) |
| 6. 10414588 | MODIFIED REDUCER | (D) |

DRAWN BY:	<i>H. Bates</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414355	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. C. Bennett</i>		E O's	
WRITER:	<i>G. L. Schram</i>			
APPROVED BY:	<i>M. K. Schram</i>		ART CONTROL NO. M-F&AE-EP140-470-A	3 Nov 1961

MANUFACTURING PLAN

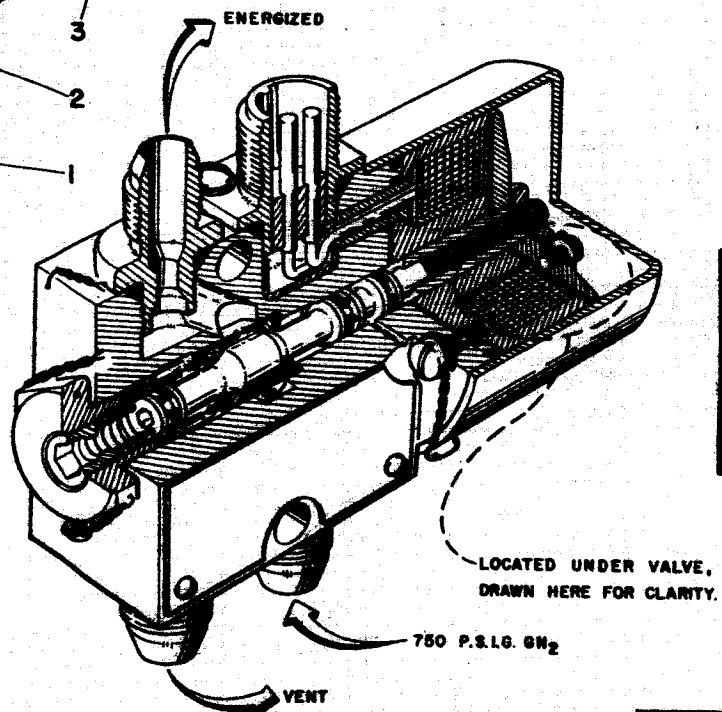
PROCEDURE EP-140

PAGE 3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 10414355 VALVE AND ORIFICE ASSEMBLY EFFECTIVITY.
2. FOR EXPLODED VIEW OF THE MV-74V CONTROL VALVE 10414027 SEE THE EP-140 WRITEUP ON 10414027.
3. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE AND ORIFICE ASSEMBLY ARE 3.910 BY 3.166 BY 1.685 INCHES.
4. THE APPROXIMATE UNIT WEIGHT IS 1.027 POUNDS.



REVISION DATE 3 NOV. 1961

MSFC - Form 1151-2 (June 1961)

M-FB AE-EP 140-470-A 10414355

- 1.4 Vibration Withstanding Capability. The valve is designed to withstand, without damage or excessive leakage while pressurized to 750 p.s.i.g., vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 10 g's,

55 to 110 c.p.s. at 0.06-inch double amplitude displacement, and

110 to 2,000 c.p.s. at 40 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve is outlined in Performance Specification 10419927 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-C-5015

MIL-E-5272

MIL-L-25567

MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130

MIL-STD-202

MIL-STD-643

MS33586

MS33653

Army Ballistic Missile Agency

ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10419909

10509300

10509302

10509303

10509305

10509311

*EFFECTIVITY OF 10414355

VEHICLE	REVISIONS
SA-T	
SA-1	
SA-2	
SA-3	
SA-4	
Spares	Before installing modify to latest configuration

*For effectivity of the MV-74V control valve 10414027 used in this assembly, see the EP-140 writeup on 10414027.

DATA SHEET	
Nomenclature: Valve and Orifice Assembly (Control Pressure)	
Drawing Numbers: 10414310	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 724 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 9 Number of Failures Reported: 0	MCBF (in cycles): 1,381 Total Cycles of Operation: 1,913 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: No leakage allowable at 750 psig	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

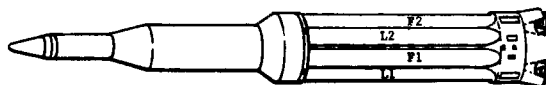
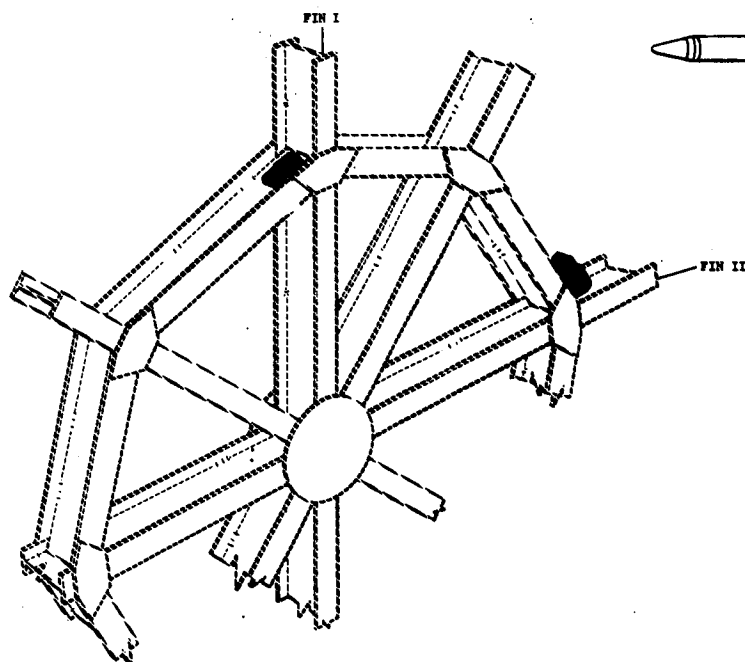
II.14.1.3
Page 1 of 6

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2, SA-3, and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-62-5, January 21, 1962, MSFC			

MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE 16 August 1961
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414310 VALVE AND ORIFICE ASSEMBLY		PROCEDURE NO. EP-140
		APPROVED <i>R. Crandall</i> PAGE 1 OF 4
<p>1. DESCRIPTION</p> <p>The valve and orifice assembly 10414310 is a component of the control pressure system. The assembly consists of an MV-74V control valve 10414027 and an orifice union assembly 10414540. Both of the valve and orifice assemblies are used in the control pressure system to supply the actuating pneumatic pressure to the control port of the 10414000 LOX relief valve assemblies No. 1 and No. 2. The three-way, two-position, electro-pneumatically operated MV-74V control valve is used in its normally closed position. The valve and orifice assemblies are both energized to open LOX relief valve assemblies No. 1 and No. 2 during either the LOX container filling or draining operation. Also, the valve and orifice assembly located just forward of container L1 on the spider beam is energized by the LOX pressurizing and relief switch assembly 10414340 during flight when the LOX container pressure reaches 60 p.s.i.a. If the pressure in the LOX container continues rising, a signal from the LOX vent emergency switch assembly 10414341 to the remaining valve and orifice assembly opens LOX relief valve No. 2 when the pressure reaches 65 p.s.i.a. The orifice union assembly is installed in the vent port of the valve and orifice assembly to restrict the flow passing through the vent port of the valve and orifice assembly. The valve and orifice assemblies are both installed on the spider beam as shown in the installation view. The various functional characteristics of the MV-74V control valve are as follows:</p> <p>1.1 Pneumatic Operating Characteristics. The control valve is capable of operating pneumatically as follows:</p> <ul style="list-style-type: none"> a. Operating media: Air, gaseous nitrogen, or helium. b. Leakage through vent port: 5 s.c.i.m. maximum with an internal pneumatic pressure of 750 ± 10 p.s.i.g. applied to the inlet port throughout the operating temperature range. c. Operating temperature range: Minus 65° to 165° F. d. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure without leakage in excess of 2 standard cubic centimeter per hour from the body or body vent while in the opened or closed position. e. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure. f. Burst pressure (without bursting): 1,875 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.) g. Flow capacity equivalent: A sharp-edged orifice of 0.110-inch diameter with 750 ± 10 p.s.i.g. pneumatic pressure applied. <p>1.2 Electrical Performance Characteristics. The electrical performance characteristics of the control valve are as follows:</p> <ul style="list-style-type: none"> a. Solenoid voltage endurance: 28 ± 1.5 v.d.c. applied to the coil continuously for 24 hours. b. Insulation resistance: 50 megohms minimum between pin "A" and the valve body and pin "B" and the valve body. c. Operating current for continuous solenoid operation: 1.2 amperes when energized with a 24 ± 0.5 v.d.c. power supply. d. Solenoid operating voltage: Actuation - 10 to 18 v.d.c. Deactuation - 10 to 1.0 v.d.c. <p style="text-align: center;">CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.</p>		

(Continued on Page 4)

REVISION DATE 3 NOV. 1961 | 10414310



GENERAL LOCATION

INSTALLATION VIEW - LOOKING FORWARD

== NOTES ==

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURR DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) TORQUE 135 TO 150 INCH-POUNDS.
- (E) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (F) LUBRICATE WITH DOW-CORNING CORP. GREASE D.C. 55 OR APPROVED EQUIVALENT.
- (G) OR APPROVED EQUIVALENT.
- (H) SEE EP-140 WRITEUP ON 10414027 FOR PERTINENT NOTES AND EXPLODED VIEW.

== LEGEND ==

10414310

VALVE AND ORIFICE ASSEMBLY ("A" REV.)

- 1. 10414540
- 2. 10414326
- 3. 10414544
- 4. MS20993CA1
- 5. MS28778-4
- 6. 10414027

ORIFICE UNION ASSEMBLY (D)
 UNION ORIFICE
 MODIFIED UNION (MAKE FROM AN815-4C)
 LOCKWIRE (A)
 PREFORMED PACKING (O-RING) (F) (G)
 HV-74V CONTROL VALVE ("D" REV.)
 EO-6, -7, & -8 (MAROTTA VALVE
 CORP. 218263) (C) (B)

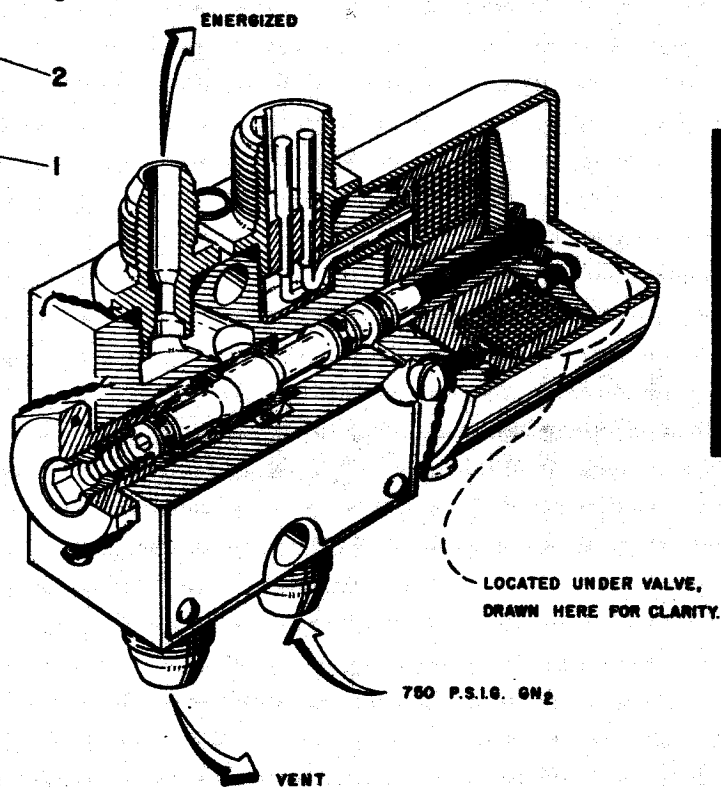
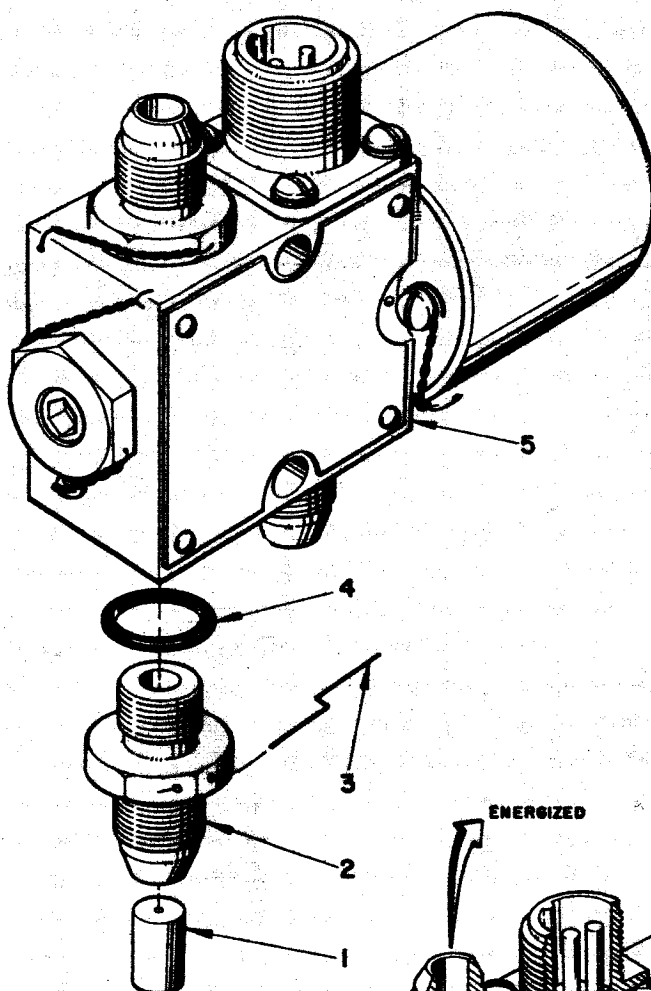
DRAWN BY:	<i>H. Bates</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414310	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. C. Penney</i>	A	EO's	3 Nov 1961
WRITER:	<i>A. L. Schenck</i>			
APPROVED BY:	<i>W. H. H. H.</i>		ANT CONTROL NO. M-F&AE-EP140-471-A	

1961)

MANUFACTURING PLAN

PROCEDURE EP-140

PAGE 3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 10414310 VALVE AND ORIFICE ASSEMBLY EFFECTIVITY.
2. FOR EXPLODED VIEW OF THE MV-74V CONTROL VALVE 10414027 SEE THE EP-140 WRITEUP ON 10414027.
3. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE AND ORIFICE ASSEMBLY ARE 3.910 BY 3.166 BY 1.685 INCHES.
4. THE APPROXIMATE UNIT WEIGHT IS 1.027 POUNDS.

REVISION DATE 3 NOV. 1961

M-F&AE-EP 140-471-A 10414310

MFC - Form 1151-2 (June 1961)

- 1.3 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 80 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
 8-milliseconds duration - sine wave, or
 6-milliseconds duration - square wave.

- 1.4 Vibration Withstanding Capability. The valve is designed to withstand, without damage or excessive leakage while pressurized to 750 p.s.i.g., vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 10 g's,
 55 to 110 c.p.s. at 0.06-inch double amplitude displacement, and
 110 to 2,000 c.p.s. at 40 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve is outlined in Performance Specification 10419927 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-C-5015
 MIL-E-5272
 MIL-L-25567
 MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-202
 MIL-STD-643
 MS33586
 MS33653

Army Ballistic Missile Agency
 ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10419909
 10509300
 10509302
 10509303
 10509305
 10509311

*EFFECTIVITY OF 10414310

VEHICLE	REVISIONS
SA-T	"A" Rev.
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev.
Spares	Before installing modify to latest configuration

*For the effectivity of the MV-74V control valve 10414027 used in this valve and orifice assembly, see the EP-140 writeup on 10414027.

DATA SHEET	
Nomenclature: Valve (Pressurization Control)	
Drawing Numbers: 10414082	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $6,266 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 159.6
Number of Components this Data Represents: 15	Total Cycles of Operation: 221
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>165°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20 - 55 cps at 3 g, 55 - 100 cps at 0.02" D.A.d.</u> <u>100 - 2000 cps at 10 g</u>	

December 1965

II.15.1.1
Page 1 of 6

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-62-5, January 21, 1962, MSFC			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE
TITLE		15 June 1962
SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414082 CONTROL VALVE		PROCEDURE EP-140
APPROVED		PAGE
<i>[Signature]</i>		1 of 4

1. DESCRIPTION.

The control valve 10414082 is a solenoid operated, two-way, two-position, normally open valve. The control valve is used to control the flow of GN₂ from the fuel container pressurization spheres. The GN₂ is used to pressurize the ST-90 stabilized platform compartment in instrument container 15. The control valve is located on the radial beam between fins III and IV on the spider beam assembly as shown in the installation view. The various functional characteristics of the control valve are as follows:

1.1 Mechanical Performance Characteristics. The control valve is capable of performing mechanically as follows:

- a. Operating media: Air, gaseous nitrogen, or helium.
- b. Operating pressure: 3,000 p.s.i.g. minimum internal pressure.
- c. Operating temperature range: -65° to +160° F.
- d. Proof pressure: 4,500 p.s.i.g. minimum internal pressure.
- e. Burst pressure (without bursting): 7,500 p.s.i.g. minimum internal pressure. (CAUTION: Use only for destructive acceptance testing.)
- f. Leakage: Internal - 2 s.c.i.m. maximum past the main valve seat when subjected to an internal pressure of 300 to 3,000 p.s.i.g. External - no external leakage allowed.
- g. Flow capacity equivalent: A sharp-edged orifice of 0.110-inch diameter.

1.2 Electrical Performance Characteristics. The control valve is capable of performing electrically as follows:

- a. Electrical rating: 18 to 30 v.d.c. with an inductive current of 1.5 a.
- b. Indicator switch: Indicates "OPEN" or "CLOSED" positions when electrically energized.
- c. Coil resistance: 23 ±2 ohms at +68° F.
- d. Solenoid voltage: Actuation to closed position - 10 to 18 v.d.c. Deactuation to normal position - 10 to 2 v.d.c.
- e. Insulation resistance: 50 megohms minimum between each isolated terminal and the valve body with 500 v.d.c. applied.
- f. The wiring diagram is shown on page 3.
- g. Solenoid endurance: 4 hours minimum continuous duty when subjected to 18 to 30 v.d.c.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

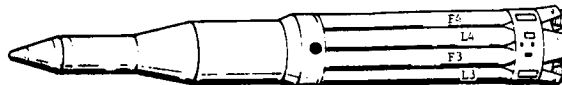
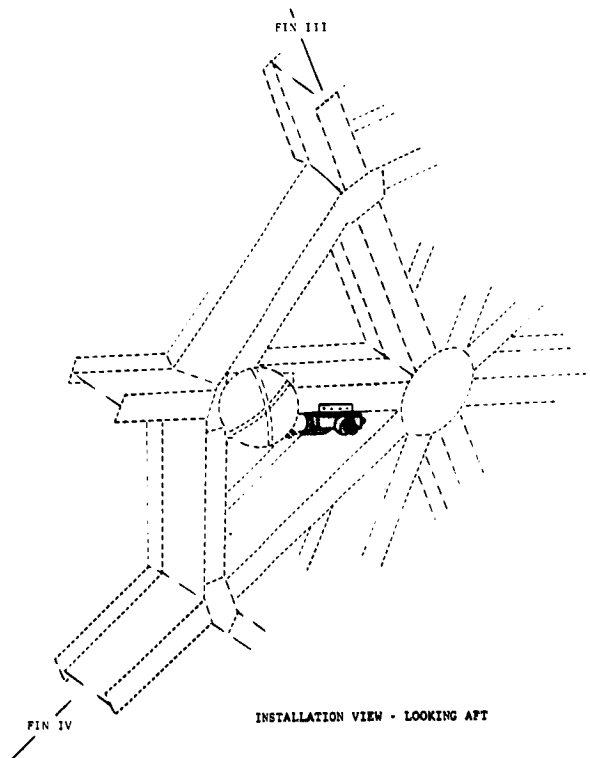
1.3 Shock Withstanding Capability. The control valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

REVISION DATA

(Continued on page 4)

10414082



GENERAL LOCATION

NOTES

- (A) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130
- (B) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (C) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (D) OR APPROVED EQUIVALENT.
- (E) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (F) LUBRICATE WITH MIL-L-4343.

LEGEND

10414082 CONTROL VALVE ("A" REV. & EO-9)
(MAROTTA VALVE CORP. 219653-111)

(A) (B) (C) (D) (E) (F)

DRAWN BY:	<i>B. Dennis</i>	ENGINEERING DRAWING RELEASE A	REVISION TO:	10414082	REVISION DATE OF THIS PAGE
PLANNER:	<i>W. E. Bennett</i>		EO'S	-9	
WRITER:	<i>W. G. Franklin</i>		ART CONTROL NO.	M-ME-EP140-786	
APPROVED BY:	<i>W. H. Hightower</i>				

(361)

MANUFACTURING PLAN

PROCEDURE

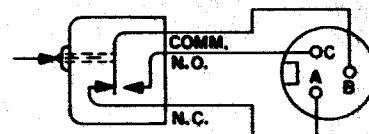
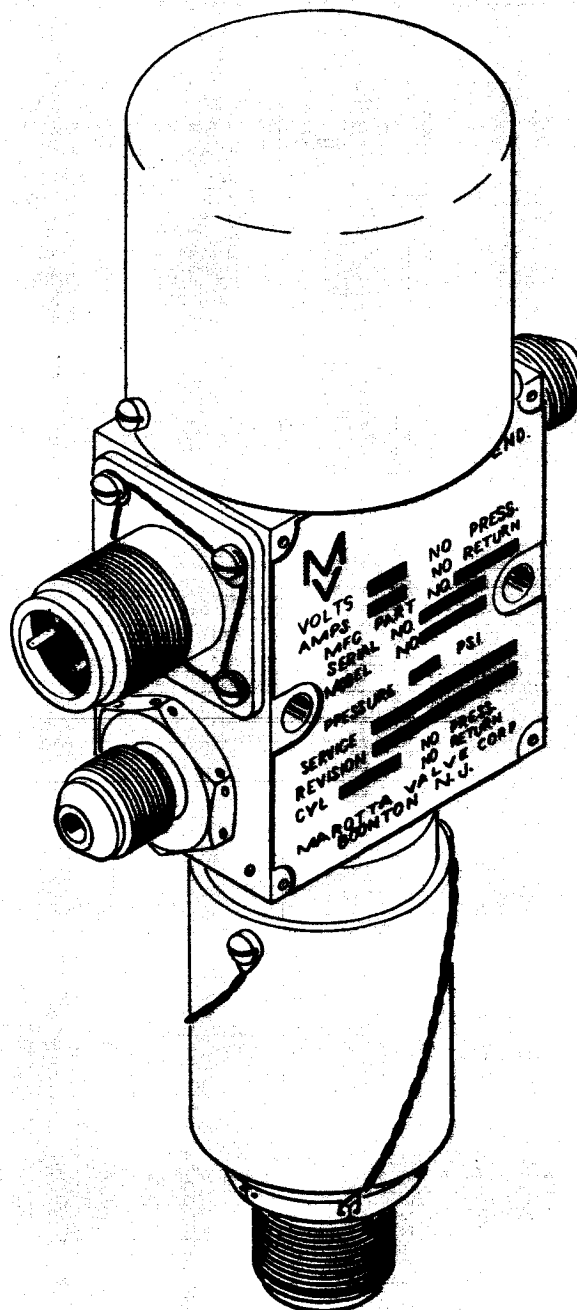
EP-140

PAGE

3

OF

4



INDICATOR SWITCH WIRING DIAGRAM

NOTES:

1. SEE PAGE 4 FOR THE 10414082 CONTROL VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE CONTROL VALVE ARE 6.22 BY 2.006 BY 3.17.
3. THE APPROXIMATE UNIT WEIGHT IS 1.28 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

REVISION DATE

M-MS-EP-140-788

10414082

1.4 Vibration Withstanding Capability. The control valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 3.0 g's,
 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 100 to 2,000 c.p.s. at 10.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance test and the preparation for delivery of the control valve are outlined in Performance Specification 10419917 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-643
 MS33586
 Army Ballistics Missile Agency-
 ABMA-STD-29

3.3 Drawings:

Ordnance Corps - 10419909
 10419917
 10509300
 10509302
 10509305
 10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"A" Rev. and EO-9
SA-1	"A" Rev. and EO-9
SA-2	"A" Rev. and EO-9
SA-3	"A" Rev. and EO-9
SA-4	"A" Rev. and EO-9
SPARES	Before installing modify to latest configuration

10414082

REVISION DATE

SUMMARY SHEET	
Nomenclature Valve (Pressurization Control)	
Drawing Numbers: 20M30171, 10414308	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $7,278 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 123 Total Number of Failures Reported: 73	MCBF (in cycles): 137.4 Total Cycles of Operation: 10,033 Vehicle Equipment: X Ground Equipment:

December 1965

II.15.1.2
Page 1 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>7</u>	Burned Out	<u>2</u>	Indicator Shows:
	Erratic	<u>1</u>	No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>4</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
<u>2</u>	Operation Sluggish		Other: _____
<u>20</u>	Out of Specs	<u>3</u>	<u>Position indicator</u>
	Oil/Moisture Saturation		<u>inoperative</u>
	Sticking	<u>3</u>	<u>Indicator light</u>
	Would Not Open		<u>flickered</u>
	Would Not Close	<u>30</u>	<u>Draws excessive</u>
	Pressure:		<u>current</u>
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-7 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valve (Pressurization Control)	
Drawing Numbers: 10414308	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $3,012 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 30 Number of Failures Reported: 7	MCHF (in cycles): 332 Total Cycles of Operation: 2,324 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>Square wave, 6 shocks at 20 g for 6 milliseconds</u>	
High Temperature: <u>+165°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20 - 55 cps at 5 g, 55 - 110 cps at 0.03" D.A.d</u> <u>110 - 2000 cps at 10 g</u>	

December 1965

II.15.1.2
Page 3 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out	<u>1</u>	Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish	<u>3</u>	Other: _____
<u>1</u>	Out of Specs		<u>Position indicator</u>
	Oil/Moisture Saturation		<u>inoperative</u>
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-65-2, Jan. 21, 1962, MSFC			

Additional information concerning the 10414308 component:

The seven failures were reported on Inspection Reports.

December 1965 (Revision)

II.15.1.2
Page 5 of 16

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		PROCEDURE
DATE		EP-140
15 June 1962		PAGE
APPROVED		1 OF 4
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414308 FUEL CONTAINER PRESSURIZING CONTROL VALVE		<i>R. Ruff</i>

1. DESCRIPTION.

The fuel container pressurizing control valve 10414308 is a two-way, two-position, normally closed, solenoid operated pressurization control valve. The pressurizing control valve is a component of the fuel container pressurization system. The valve is used to pressurize the fuel container by allowing the flow of GN₂ from the high pressure sphere assemblies into the container. The four pressurizing control valves used on the vehicle are controlled by electrical signals from the fuel container pressure switch 10414338. During powered flight, the pressurizing control valves are sequenced by programed tape cutting them in or out of the fuel container pressure switch electrical circuit as required due to GN₂ source pressure decay and vehicle acceleration. The pressurizing control valve is installed in the forward skirt of containers F1, F2, F3, and F4 as shown in the installation view. The various functional characteristics of the pressurizing control valve are as follows:

1.1 Mechanical Performance Characteristics. The pressurizing control valve is capable of performing mechanically as follows:

- a. Operating media: Air or gaseous nitrogen.
- b. Operating temperature range: -65° to +125° F.
- c. Nominal operating pressure: 3,000 p.s.i.g. minimum internal pressure.
- d. Proof pressure: 4,500 p.s.i.g. minimum internal pressure.
- e. Burst pressure (without bursting): 7,500 p.s.i.g. minimum internal pressure. (CAUTION: Use only for destructive acceptance testing.)
- f. Internal leakage allowed past the main valve assembly seat: 5 s.c.i.m. maximum with the inlet port pressure ranging from 300 to 3,000 p.s.i.g. and with the pilot valve assembly solenoid deenergized.
- g. Internal leakage allowed through the main valve assembly poppet stem vent: 2 s.c.i.m. maximum with the inlet pressure ranging from 300 to 3,000 p.s.i.g. and with the pilot valve assembly solenoid deenergized.
- h. Internal leakage allowed from the pilot valve assembly vent port: 5 s.c.i.m. maximum with the inlet port pressure ranging from 300 to 3,000 p.s.i.g. and with the solenoid energized.
- i. External leakage allowed: 2 standard cubic centimeters per hour with the inlet port pressurized to 3,000 p.s.i.g. pneumatic pressure.

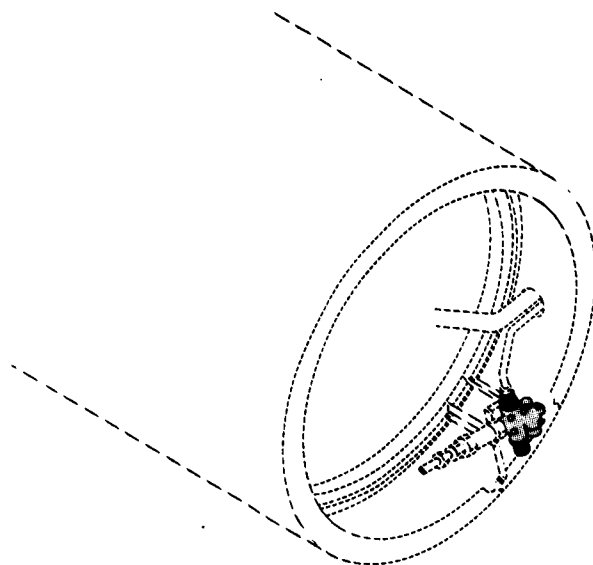
1.2 Electrical Performance Characteristics. The pressurizing control valve is capable of performing electrically as follows:

- a. Solenoid operating voltage: 22 to 30 v.d.c.
- b. Maximum operating current of solenoid coil: 1.0 a. at 24 v.d.c. and at +70° ±5° F.
- c. Solenoid coil resistance: 24 to 25 ohms at +70° ±5° F.
- d. Insulation resistance: 50 megohms minimum between each isolated terminal and the valve body with 500 v.d.c. applied.
- e. Solenoid operating voltage with 3,000 p.s.i.g. applied to the inlet port: Actuation - 18 v.d.c. maximum. Deactuation - 10 to 2 v.d.c.
- f. The indicator wiring schematic is shown on page 3.

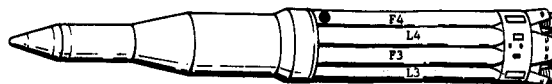
REVISION DATE
4 JAN 1963

(Continued on page 4)

10414308



INSTALLATION VIEW - LOOKING AFT
(TYPICAL ON CONTAINERS F1, F2, F3, & F4)



GENERAL LOCATION

10414300 FUEL CONTAINER PRESSURIZING CONTROL
VALVE ("B" REV.) & EO-7 (MAROTTA VALVE
CORP. 219664-1) A B C D
B P

NOTES

- A IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- B STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- C CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- D OR APPROVED EQUIVALENT.
- E CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305, TYPE IV, FOR PNEUMATIC SERVICE.
- F LUBRICATE ALL SEALS AND SLIDING SURFACES WITH DOW-CORNING CORP., D.C. 55 OR APPROVED EQUIVALENT.

DRAWN BY:	<i>B. Dennis</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414308	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. E. Bennett</i>	B	EO'S	-7
WRITER:	<i>W. G. Franklin</i>			
APPROVED BY:	<i>M. S. Hightower</i>		ART CONTROL NO. M-ME-EP140-784	

MANUFACTURING PLAN

PROCEDURE

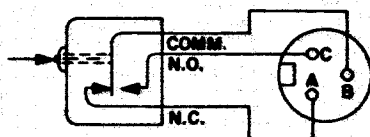
EP-140

PAGE

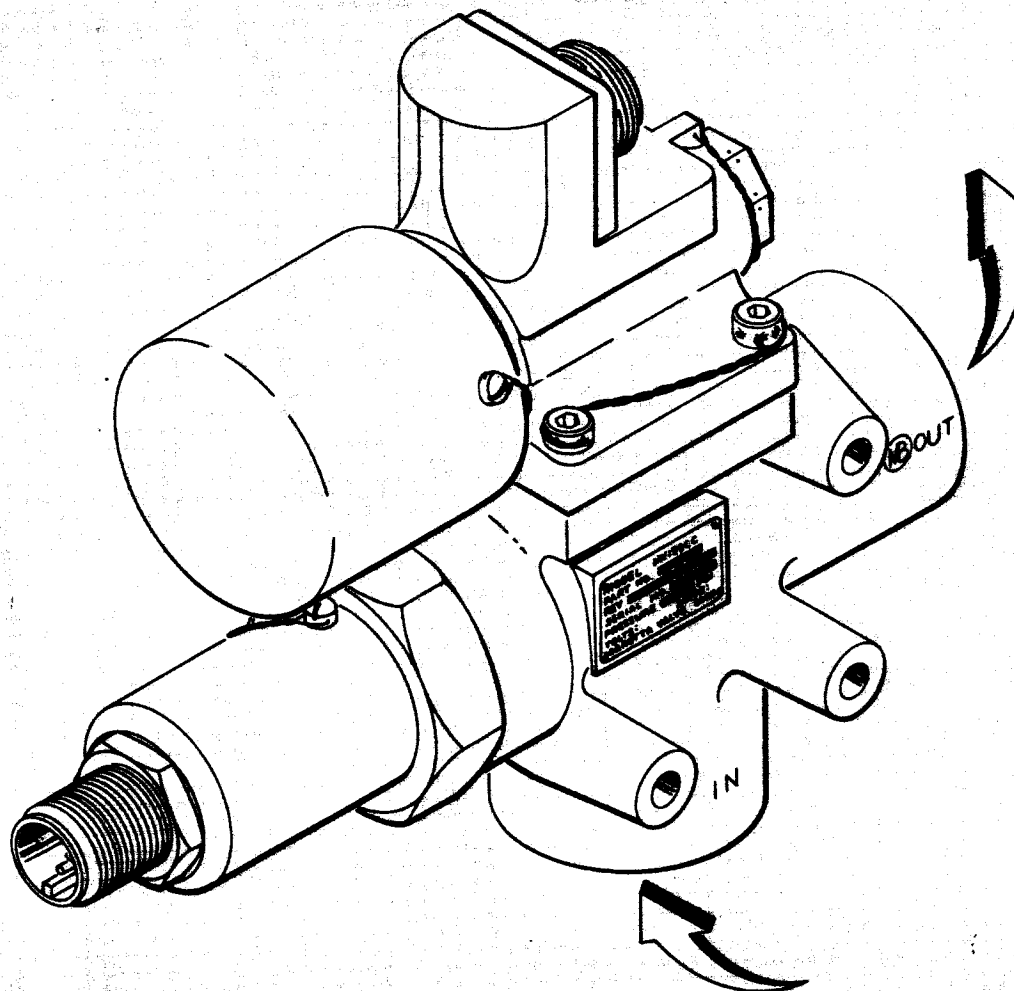
3

OF

4



INDICATOR WIRING DIAGRAM



NOTES:

1. SEE PAGE 4 FOR THE 10414308 FUEL CONTAINER PRESSURIZING CONTROL VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURIZING CONTROL VALVE ARE 6.40 BY 2.06 BY 5.33 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 1.50 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

REVISION DATE

M-MS-EP140-704

10414308

MSFC - Form 1151-2 (June 1961)

MANUFACTURING PLAN

1.2 (con.)

g. Solenoid endurance: 4 hours minimum continuous operation.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The pressurizing control valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The pressurizing control valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 3.0 g's,

55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and

100 to 2,000 c.p.s. at 10.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance test and the preparation for delivery of the pressurizing control valve are outlined in Performance Specification 10419972 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33586

Army Ballistics Missile

Agency - ABMA-STD-29

3.3 Drawings:

Ordnance Corps - 10419909
10419972
10509300
10509302
10509305
10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"B" Rev.
SA-1	"B" Rev.
SA-2	"B" Rev.
SA-3	"B" Rev. and EO-7
SA-4	"B" Rev. and EO-7
SPARES	Before installing modify to latest configuration

10414308

REVISION DATE

4 JAN 1963

DATA SHEET	
Nomenclature: Valve (Pressurization Control)	
Drawing Numbers: 20M30171	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 8,620 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 93 Number of Failures Reported: 66	MCBF (in cycles): 116 Total Cycles of Operation: 7,709 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: (Same as Page 3, II.15.1)	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

II.15.1.2
Page 11 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>6</u>	Burned Out	<u>2</u>	Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
<u>1</u>	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>3</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
<u>2</u>	Operation Sluggish		Other: _____
<u>19</u>	Out of Specs	<u>3</u>	<u>Indicator light</u>
	Oil/Moisture Saturation		<u>flickered</u>
	Sticking	<u>30</u>	<u>Draws excessive</u>
	Would Not Open		<u>current</u>
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5, SA-6 and SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30171 component:

All components processed on March 28, 1964, which had failed "excessive current" or "out of specs", were returned to the vendor. Many of them had drawn excessive current in addition to being out of specification in other ways.

The sixty-six failures were written on Inspection Reports.

Fuel Tank Pressurization Solenoid Control Valve, Part No. 20M30171

The fuel tank pressurization solenoid control valves admit GN_2 from the fuel tank high-pressure spheres into the fuel tanks through fuel tank pressure orifices when pressure decay occurs. The actuation of the control valves, through a flight sequencer, is initiated by a signal from the fuel tank pressure switch when GN_2 pressure decreases to a predetermined level.

For emergency venting of the high-pressure spheres the pressurization control valves can be opened by a command signal, while the fuel vent valves are simultaneously actuated through a 750-psig ground pressure control line.

1. Vendor - Marotta Valve Corp., Part No. 219664-1
2. Location -
 - a. One valve at Station 922, fuel tank No. 3
 - b. One valve at Station 923, fuel tank No. 4
 - c. One valve at Station 932, fuel tank No. 1
3. Service - GN_2
4. Temperature - Operating: 125 to -65°F
5. Pressure -
 - a. Operating: 3000 psig
 - b. Proof: 4500 psig
 - c. Burst: 7500 psig
6. Lubrication - Lubricate seals and sliding surfaces with DC - 55 grease (Dow Corning)
7. Leakage -
 - a. Internal:
 - (1) Main seat: 5 scim maximum at 300 to 3000 psig
 - (2) Poppet stem vent: Not to exceed 2 scim when pressurized at 300 to 3000 psig
 - (3) Pilot valve assembly: 5 scim maximum when inlet port is pressurized at 300 to 3000 psig
 - b. External: 2 scim maximum at 3000 psig
8. Electrical Characteristics -
 - a. Operating current: 1.2 amperes at 28 ± 0.5 vdc with pilot valve assembly solenoid energized
 - b. Operating voltage: 22 to 32 vdc

c. Insulation resistance:

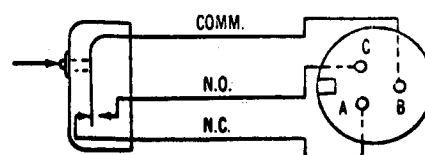
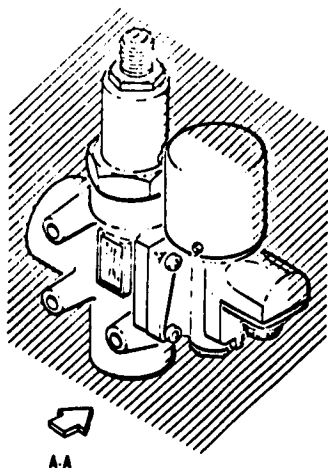
- (1) Each terminal of pilot valve solenoid connector to valve body: 50 megohms, minimum
- (2) Each terminal of position switch connector to valve body: 50 megohms, minimum

d. Position switch indications:

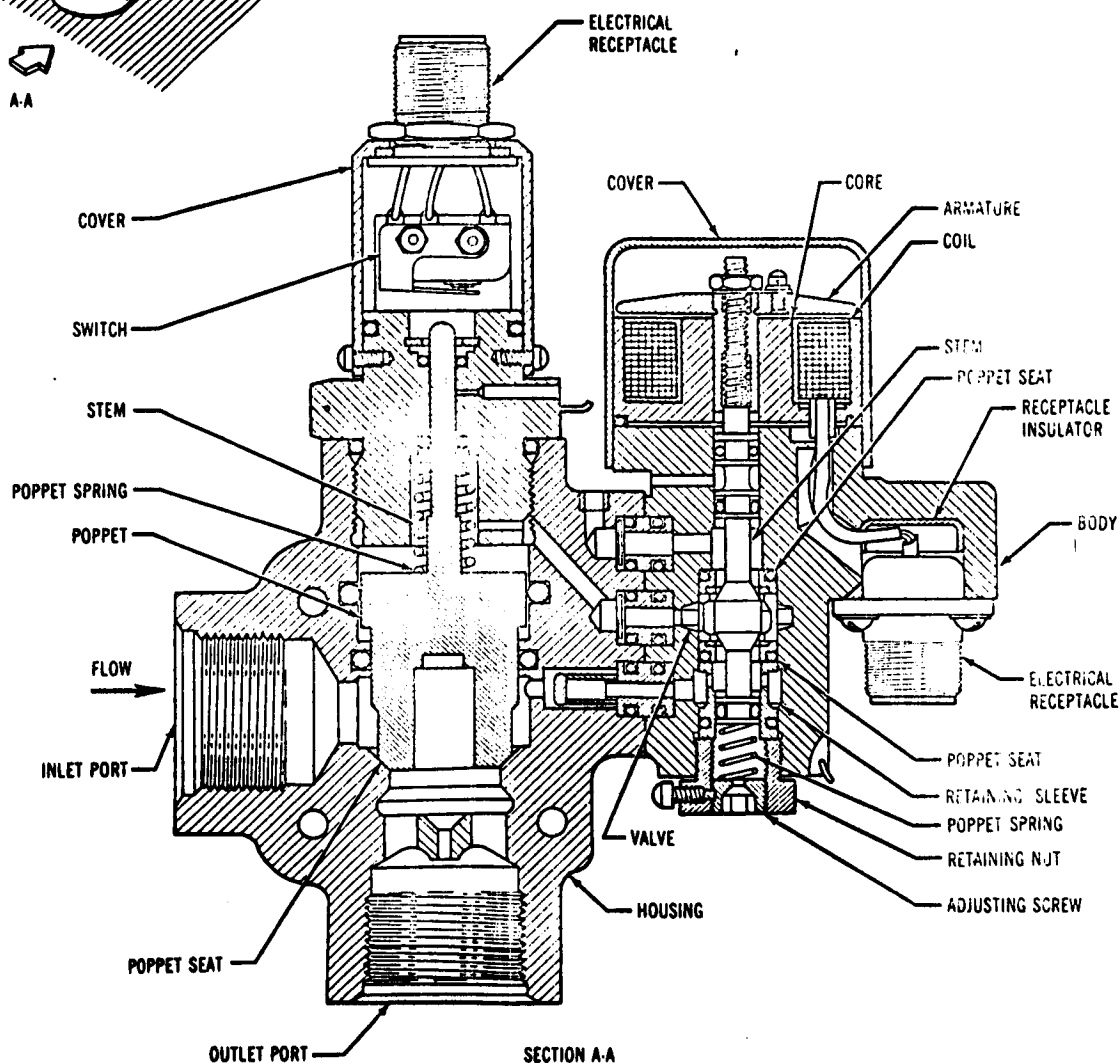
- (1) Closed: Pins A and B show continuity
- (2) Open: Pins B and C show continuity

e. Solenoid action:

- (1) Open: With inlet port pressure of 3000 psig, pilot valve solenoid shall actuate main valve from fully closed to fully open at increasing voltage of 18 vdc
- (2) Closed: Main valve shall close at 10 vdc maximum, 2.0 vdc minimum



INDICATOR WIRING DIAGRAM



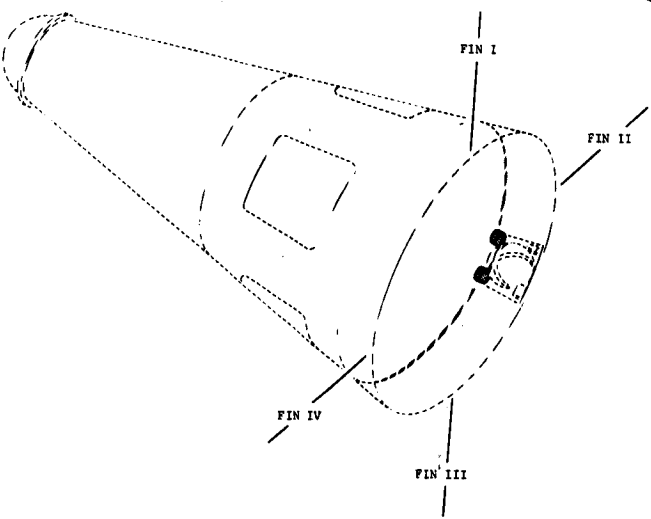
FUEL TANK PRESSURIZATION SOLENOID CONTROL VALVE, 20M30171 - SECTIONAL VIEW

DATA SHEET	
Nomenclature: Valve, Fuel Control	
Drawing Numbers: 10414358	Vendor: Marotta Valve Corp.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 8097 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 7 Number of Failures Reported: 0	MCBF (in cycles): 123.5 Total Cycles of Operation: 171 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

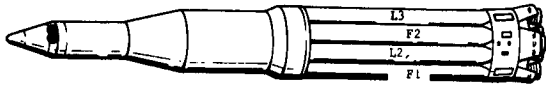
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		PROCEDURE
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414358 2 WAY, 2 POSITION, NC, SOLENOID OPERATED VALVE ASSEMBLY	DATE 12 March 1962 APPROVED <i>R. Paul</i>	EP-140 PAGE 1 of 4
<p>1. DESCRIPTION.</p> <p>The 2 way, 2 position, NC, solenoid operated valve assembly 10414358 is a component of the S-V dummy stage gaseous nitrogen system. One valve assembly is used to control the flow of gaseous nitrogen from the fuel container pressurization sphere filling line to the S-V dummy stage high pressure storage sphere. The storage sphere is used to pressurize the S-V dummy stage water ballast tank during flight to maintain the structural integrity of the tank. Another valve assembly is used to vent the S-V dummy stage high pressure storage sphere overboard. The valve assemblies are installed on the bottle assembly 10410825 located in the payload adapter as shown in the installation view. The various functional characteristics of the valve assembly are as follows:</p> <p>1.1 <u>Pneumatic Operating Characteristics.</u> The valve assembly is capable of operating pneumatically as follows:</p> <ul style="list-style-type: none"> a. Operating temperature range: -65° to $+125^{\circ}$ F. b. Service media: Gaseous nitrogen, compressed air, or helium. c. Nominal operating pressure: 3,000 p.s.i.g. internal pneumatic pressure. d. Proof operating pressure: 4,500 p.s.i.g. internal pneumatic pressure. e. Burst pressure (without bursting): 7,500 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.) f. Flow capacity equivalent: A sharp-edged orifice of 0.120-inch diameter with 3,000 p.s.i.g. pneumatic pressure applied. g. Leakage past the main valve seal with valve in closed position and internal pressure of 300 to 3,000 p.s.i.g.: 5 s.c.i.m. maximum. h. External leakage allowed: None. <p>1.2 <u>Electrical Performance Characteristics.</u> The electrical performance characteristics of the valve assembly are as follows:</p> <ul style="list-style-type: none"> a. Insulation resistance: 50 megohms minimum between each isolated terminal and the valve body with a 500 v.d.c. insulation resistance tester. b. Solenoid voltage endurance: 22 to 32 v.d.c. applied to the coil for a minimum of 24 hours continuous duty. c. Operating current: 1.0 to 1.2 a. with a 28 v.d.c. power supply. d. Solenoid operating voltage: 10 to 18 v.d.c. to open (actuate) 10 to 2 v.d.c. to close (deactuate). e. Solenoid coil resistance: 23 to 26 ohms at 68° F. <p style="text-align: center;">CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.</p> <p>1.3 <u>Shock Withstanding Capability.</u> The valve assembly is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 20 g's in each of the three major axes:</p>		
REVISION DATE <div style="border: 1px solid black; height: 15px; width: 100%;"></div>	(Continued on page 4)	
		<div style="border: 1px solid black; padding: 2px; display: inline-block;">10414358</div>

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA
PAGE	OF	PROCEDURE	MANUFACTURING PLAN	
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INSTALLATION VIEW - PAYLOAD SECTION
LOOKING FORWARD



GENERAL LOCATION

== NOTES ==

(A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305, TYPE IV, FOR PNEUMATIC SERVICE.

(B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.

(C) STAMP THE CURE DATE OF OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.

(D) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.

(E) OR APPROVED EQUIVALENT.

(F) LOCKWIRE IN ACCORDANCE WITH MS33540.

(G) TORQUE 430 TO 550 INCH-POUNDS.

(H) LUBRICATE WITH DOW-CORNING CORP., D.C. 55 OR APPROVED EQUIVALENT.

(J) LUBRICATE THE SLIDING SURFACES WITH DOW-CORNING CORP., D.C. 55 OR APPROVED EQUIVALENT.

(K) TORQUE 4 TO 6 INCH-POUNDS.

(L) TORQUE 8 TO 10 INCH-POUNDS.

(M) LOCATE RECEPTACLE KEY TOWARD COIL AS SHOWN.

10414358

<ol style="list-style-type: none"> 1. AN995C20 2. J67A12 3. 106481 4. MS20995C32 5. 117612 6. 117621 7. 117571 8. J200A111 9. 117592 10. 108261-1 11. J200A7 12. 117582-1 13. 201892 14. J200A12 15. 125591-3 16. 119552-3 17. 111071 18. J200A2 19. 102961 20. 117631 21. 108031 22. 107281 23. 107291 24. 107331 25. 108043 26. 202021 27. J887 28. 213542-1312 29. J200A28 30. AN515C4-5 31. AN936A4 32. MS3102E-10SL-4P 33. J2008113 34. 107311 35. 123504 	<p>2 WAY, 2 POSITION, NC, SOLENOID OPERATED VALVE ASSEMBLY (MAROTTA VALVE CORP., BOONTON, NEW JERSEY, 206003) (A) (B) (C) (D) (E)</p> <p>LOCKWIRE (F)</p> <p>LOCKWIRE SCREW</p> <p>LOCKING SLUG</p> <p>LOCKWIRE (F)</p> <p>RETAINING NUT (G)</p> <p>ADJUSTING SCREW</p> <p>POPPET SPRING</p> <p>PREFORMED PACKING (O-RING) (E) (H)</p> <p>SEAT RETAINER</p> <p>BACKUP WASHER</p> <p>PREFORMED PACKING (O-RING) (E) (H)</p> <p>VALVE POPPET (J)</p> <p>SEAT ASSEMBLY</p> <p>PREFORMED PACKING (O-RING) (E) (H)</p> <p>RETAINER RING</p> <p>CORE SCREW (K)</p> <p>CORE SCREW (K)</p> <p>PREFORMED PACKING (O-RING) (E) (H)</p> <p>COVER SCREW (2 PLACES)</p> <p>COIL COVER</p> <p>SPRING</p> <p>ARMATURE LOCK NUT (L)</p> <p>LOCKWIRE SCREW</p> <p>FLAT WASHER</p> <p>ARMATURE CLIP AND LOCK</p> <p>ARMATURE AND GUIDE ASSEMBLY</p> <p>ARMATURE STUD</p> <p>COIL AND CORE ASSEMBLY</p> <p>PREFORMED PACKING (O-RING) (E) (H)</p> <p>SCREW (4 PLACES)</p> <p>WASHER (4 PLACES)</p> <p>ELECTRICAL RECEPTACLE (W)</p> <p>PREFORMED PACKING (O-RING) (E) (H)</p> <p>RECEPTACLE INSULATOR</p> <p>VALVE BODY</p>
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MANUFACTURING PLAN

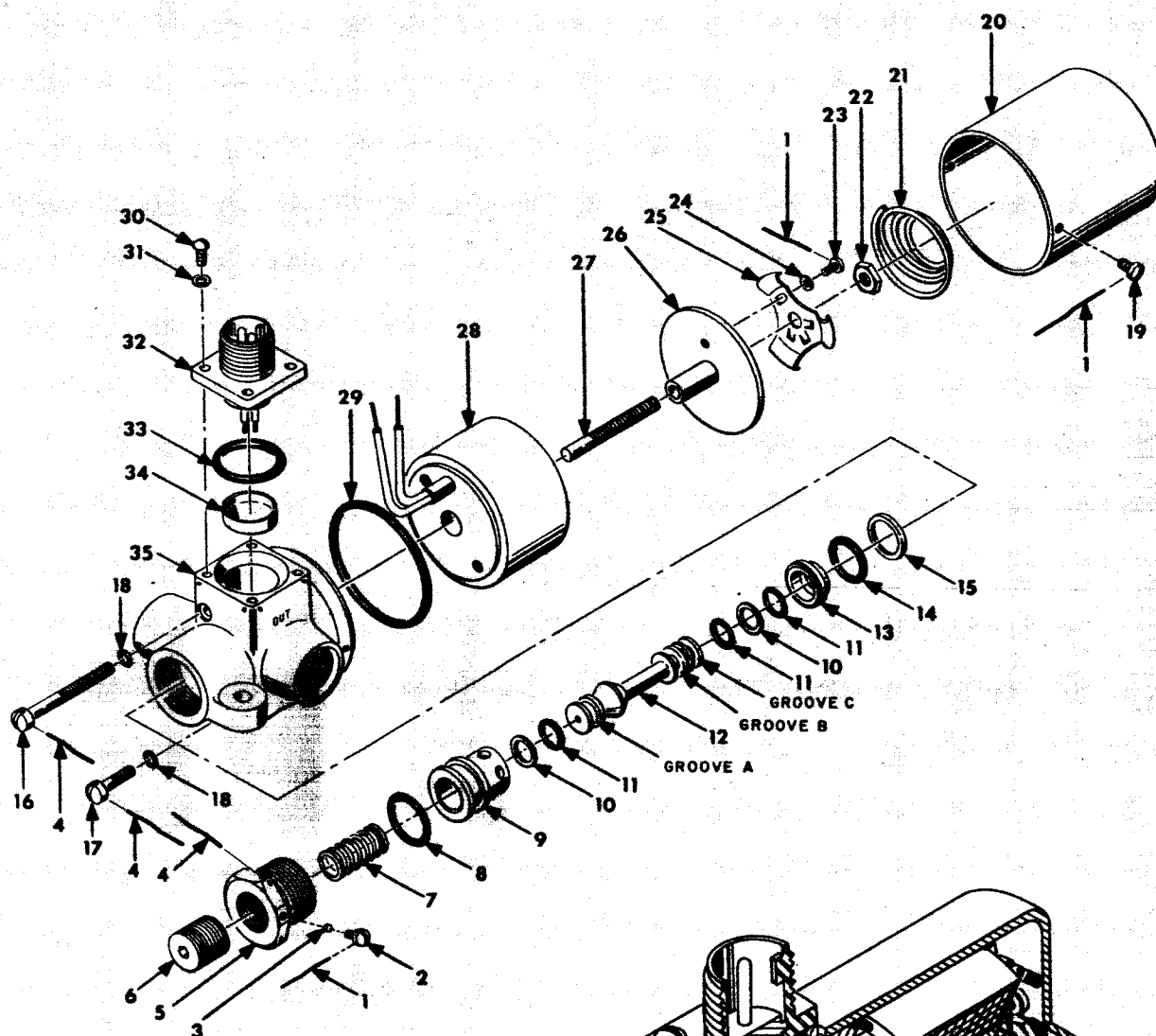
PROCEDURE

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PAGE

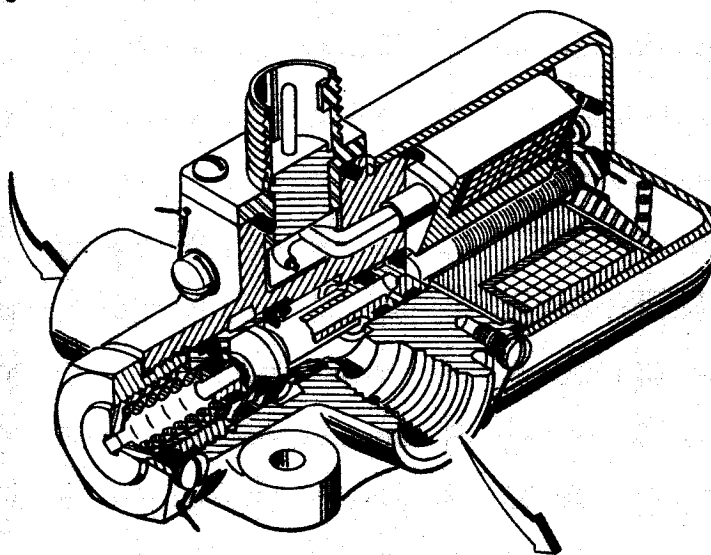
3

of 4



NOTES:

1. SEE PAGE 4 FOR THE 10414358 2WAY, 2 POSITION, NC, SOLENOID OPERATED VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE SOLENOID OPERATED VALVE ASSEMBLY ARE 3.35 BY 2.67 BY 2.05 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 0.80 POUNDS.



REVISION DATE

MSFC - Form 1151-2 (June 1961)

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1.3 Shock Withstanding Capability. (con.)

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The valve assembly is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

15 to 45 c.p.s. at one g,
45 to 90 c.p.s. at 0.02-inch double amplitude displacement, and
90 to 2,000 c.p.s. at 5 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve assembly are outlined in Performance Specification 10M01078 and Packaging and Packing Specification 10509302.

3. REFERENCES.**3.1 Specifications:**

Military - MIL-C-5015
MIL-E-5272

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile
Agency - ABMA-STD-18

3.2 Drawings:

Ordnance Corps - 10509302
10509303
10509305
10509311
10M01078

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	
SA-1	EO-1
SA-2	EO-1
SA-3	EO-1
SA-4	EO-1
SPARES	Before installing modify to latest configuration

10414358

REVISION DATE

DATA SHEET	
Nomenclature: Valve, Fuel Level Control	
Drawing Numbers: 10414055 Saturn I Vehicle	Vendor: NASA/MSFC Mfg. - Fab. Div. Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 5,187 $\times 10^{-6}$ /cy. Number of Components this Data Represents: 9 Number of Failures Reported: 0	MCBF (in cycles): 192.8 Total Cycles of Operation: 267 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
<p>Acceleration:</p> <p>Altitude:</p> <p>Radio Interference:</p> <p>Salt Spray:</p> <p>Shock:</p> <p>High Temperature:</p> <p>Low Temperature:</p> <p>Ambient Room Temperature:</p> <p>Thermal Shock:</p> <p>Shock Impact (Flat Drop):</p> <p>Leakage Rate:</p> <p>Humidity:</p> <p>Random Noise:</p> <p>Sine Wave Method:</p> <p>Vibration:</p>	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MANUFACTURING PLAN

TITLE

SATURN COMPONENTS ASSEMBLY PROCEDURE
10414055 FUEL LEVEL CONTROL VALVE ASSEMBLY

DATE

20 April 1961

PROCEDURE

EP-140

APPROVED

H. Paul

PAGE

1 of 4

1. DESCRIPTION.

The fuel level control valve assembly 10414055 is a normally closed pneumatically operated poppet valve. The valve is used to complement the fuel fill and drain valve 10414352. The control valve is used to obtain a predetermined fuel level after the fill and drain valve has been used to fill the container to the approximate level desired. The valve assembly is installed on the elbow in the fuel transfer manifold assembly in fuel container F2 as shown in the installation view. The various functional characteristics of the fuel level control valve are as follows:

- 1.1 Pneumatic Override Characteristics. The pneumatic override feature is ground controlled to open the valve poppet for filling the fuel container to a predetermined level. When the poppet opens the switch circuit is opened signaling to the blockhouse that the valve is open. The pneumatic override feature is capable of performing as follows:

- Minimum operating pressure: 500 p.s.i.g.
- Nominal operating pressure: 750 p.s.i.g.
- Proof operating pressure: 1,125 p.s.i.g.
- Burst pressure (without bursting): 1,875 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
- Operating temperature range: Minus 65° to plus 125° F.
- Pneumatic leakage past control cylinder: 1 s.c.i.m. maximum at the nominal operating pressure.
- Operating media: Air or gaseous nitrogen.

- 1.2 Flow Chamber Characteristics. The flow chamber characteristics are as follows:

- Operating medium: RP-1 fuel.
- Flow rate: 200 g.p.m. (water) at a flow pressure of 50 p.s.i.g. with 500 p.s.i.g. minimum pressure on the control port at ambient room temperature.
- Proof operating pressure: 75 p.s.i.g.
- Leakage past poppet seat: No leakage with the valve in closed position and fluid (water) pressurized to 50 p.s.i.g. and applied to external side of the poppet.

- 1.3 Electrical Performance Characteristics. The magnetic switch circuit is closed when the poppet is within 0.100-inch maximum and 0.010-inch minimum of its seat. A continuity check between pins "A" and "B" on the connector with the valve closed must indicate less than 0.5 ohm resistance. With the valve in the open position the insulation resistance between pin "A" and valve body, pin "B" and the valve body, and pins "A" and "B" must be a minimum of 50 megohms at 500 volts d.c.

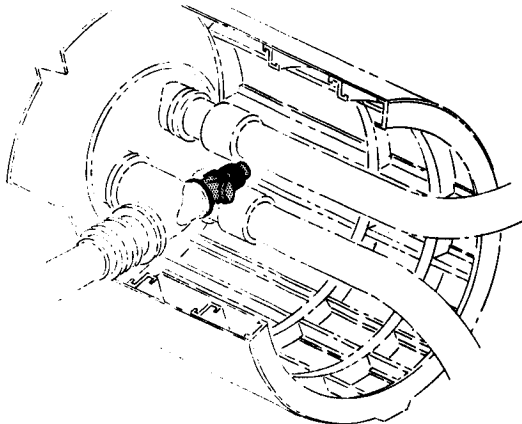
CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

(Continued on Page 4)

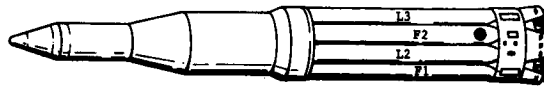
REVISION DATE

27 APR 1962

10414055



INSTALLATION VIEW - LOOKING FORWARD



GENERAL LOCATION

== NOTES ==

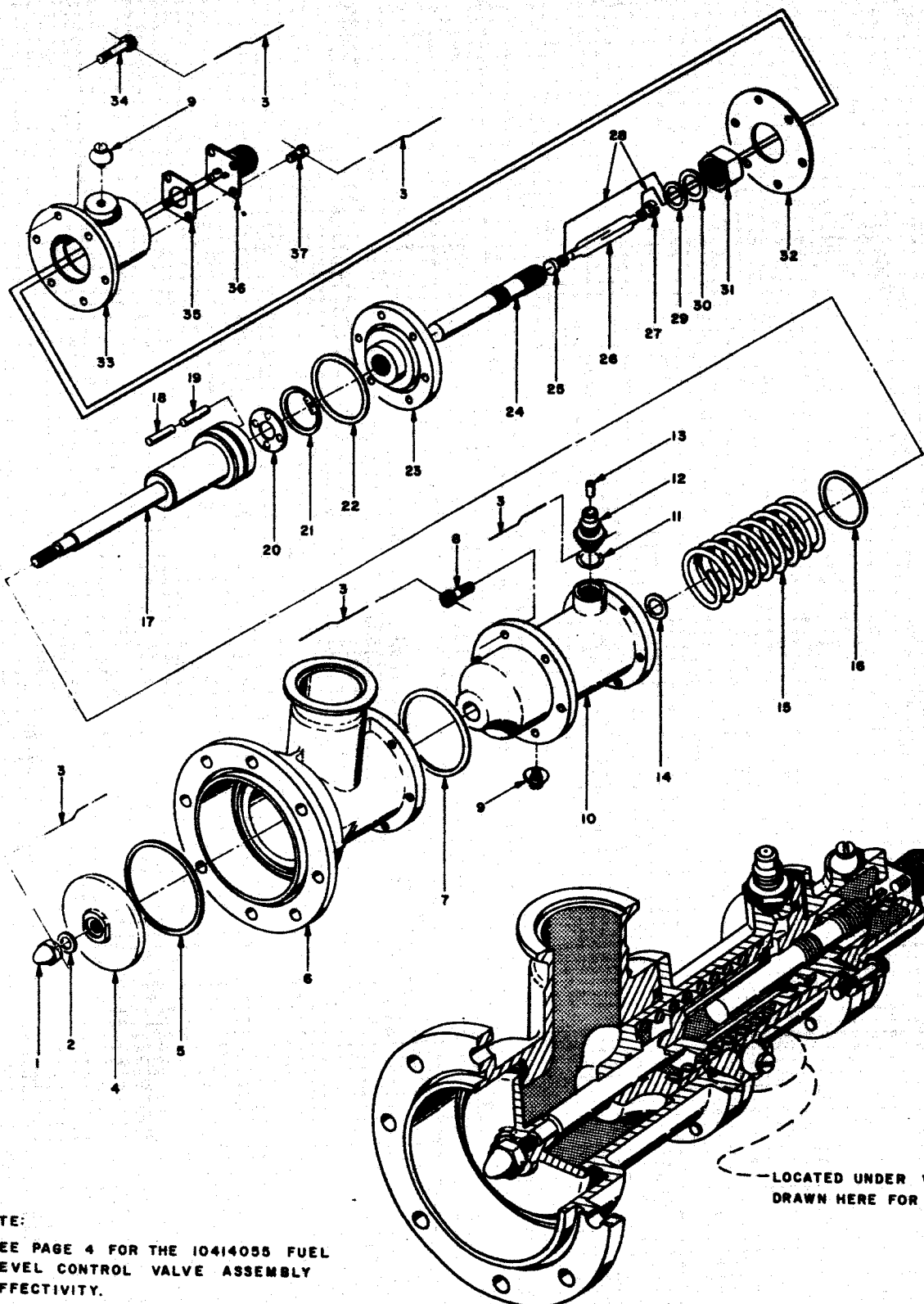
- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) TORQUE 50 TO 70 INCH-POUNDS.
- (E) APPLY DOW CORNING CORP. FLUOROSILICONE GREASE, QC-2-0026, OR APPROVED EQUIVALENT, TO FIRST THREE EXTERNAL THREADS ONLY.
- (F) LUBRICATE WITH DOW CORNING CORP. FLUOROSILICONE GREASE, QC-2-0026, OR APPROVED EQUIVALENT.
- (G) OR APPROVED EQUIVALENT.
- (H) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (J) MOLD AND CURE IN PLACE USING RUBBER, MIL-R-3065B GRADE SB-715, A₁B₁E₅.
- (K) RADIOGRAPHICALLY INSPECT AND ACCEPT IN ACCORDANCE WITH ABMA-STD-41.
- (L) TORQUE 20 TO 25 INCH-POUNDS.
- (M) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER FLANGE CONTACTS THE MATING SURFACE.
- (N) TORQUE 70 TO 120 INCH-POUNDS.
- (P) MAY BE CUT AND INSTALLED IN ANY INCREMENT NECESSARY TO OBTAIN THE REQUIRED SWITCH ADJUSTMENT.
- (Q) INSTALL MAGNETS WITH LIKE POLES NEAR SURFACE B.
- (R) ADJUST TO INDICATE VALVE CLOSED WHEN THE POPPET IS WITHIN 0.100-INCH MAXIMUM AND 0.010-INCH MINIMUM OF SEATING.
- (S) SOLDER CONNECTIONS IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300 WITH SOLDER CONFORMING TO SPEC. QQ-S-571C/SN60. TRIM TUBING AS CLOSE TO CONNECTOR AS POSSIBLE.
- (T) TORQUE 800 TO 1,000 INCH-POUNDS.

== LEGEND ==

- | | |
|---|--|
| <p>10414055</p> <ol style="list-style-type: none"> 1. 10414291 2. 10414290 3. MS20995C20 4. 10414287 10414292 5. 10414292-2 6. 10414292-1 7. MS29513-137 8. 10414297-1 9. 10414267 10. 10414279 11. MS28778-4 10414504 12. 10414502 13. 10414503 14. MS29513-14 15. 10414289 16. MS29513-27 17. 10414304 18. 10414272 19. 10414224 20. 10414223 21. 10414269 22. MS29513-129 23. 10414282 10414202 24. 10414201 25. 10414216 26. 10414215 27. 10414598 28. 29. MS28778-6 30. 10414237 31. 10414207 32. 10414288 33. 10414286 34. 10414297-2 35. 10414294 36. 8944216 37. MS35276-14 | <p>FUEL LEVEL CONTROL VALVE ASSEMBLY ("A" REV.) (A) (B) (C)</p> <p>NUT (D) (E)</p> <p>SEAL (PRECISION RUBBER PRODUCTS CORP., 110 - 1/4) (F) (G)</p> <p>LOCKWIRE (H)</p> <p>POPPET</p> <p>FUEL LEVEL CONTROL VALVE HOUSING ASSEMBLY</p> <p>SEAL (I)</p> <p>HOUSING (J)</p> <p>PREFORMED PACKING (O-RING) (K)</p> <p>CAP SCREW (5 PLACES) (L)</p> <p>VENT SEAL (M)</p> <p>CONTROL CYLINDER (EO-2) (N) (O)</p> <p>PREFORMED PACKING (O-RING) (P)</p> <p>FUEL LEVEL CONTROL VALVE ORIFICE UNION ASSEMBLY ("A" REV.)</p> <p>MODIFIED UNION (Q) (R)</p> <p>UNION ORIFICE</p> <p>PREFORMED PACKING (O-RING) (S)</p> <p>SPRING</p> <p>PREFORMED PACKING (O-RING) (T)</p> <p>PISTON SHAFT (U)</p> <p>SPACER (4 PLACES) (V)</p> <p>BAR MAGNET (REVERE CORP. OF AMERICA, P-6972-3) (4 PLACES) (W) (X)</p> <p>PISTON WASHER</p> <p>RETAINING RING (KOHINOOR INC., 5001-100-C-MF) (Y)</p> <p>PREFORMED PACKING (O-RING) (Z)</p> <p>RETAINER</p> <p>LOX RELIEF VALVE SWITCH ASSEMBLY ("B" REV., EO-4A & -5) (AA)</p> <p>SWITCH HOLDER ("A" REV.) (AB)</p> <p>SWITCH BUSHING</p> <p>SWITCH (EO-2) (REVERE CORP. OF AMERICA, GLASWICH, E-5600-23 OR -33) (AC)</p> <p>SWITCH BUSHING</p> <p>ELECTRICAL WIRING (SPEC. MIL-W-16878, TYPE E, NICKEL PLATED, AMG NO. 20) (AD)</p> <p>PREFORMED PACKING (O-RING) (AE)</p> <p>BACKUP WASHER</p> <p>SWITCH NUT (AF)</p> <p>GASKET (RAYBESTOS MANHATTAN INC., K-68) (AG)</p> <p>CONNECTOR MOUNT</p> <p>CAP SCREW (AH)</p> <p>GASKET (RAYBESTOS MANHATTAN INC., K-68) (AI)</p> <p>CONNECTOR ("A" REV.) (CANNON ELECTRIC CO., GS02-10SL-4P-111) (AJ) (AK)</p> <p>SCREW (4 PLACES)</p> |
|---|--|

DRAWN BY:	<i>J. Rott</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414055	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. E. Bennett</i>	A	EO'S		27 Apr 1962
WRITER:	<i>C. F. Schunk</i>		ART CONTROL NO.		
APPROVED BY:	<i>Michael Smith</i>				

MANUFACTURING PLAN

PROCEDURE
EP-140PAGE
3 of 4

NOTE:

SEE PAGE 4 FOR THE 10414055 FUEL
LEVEL CONTROL VALVE ASSEMBLY
EFFECTIVITY.

REVISION DATE 7 JULY 1961

MSPC - Form 1151-2 (June 1961)

B-F&AE-EP140-421-A

10414055

MANUFACTURING PLAN

- 1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
 8-milliseconds duration - sine wave, or
 6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at three g's,
 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10419947 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Federal - QQ-S-571/SN60
 Military - MIL-E-5272
 MIL-J-5624
 MIL-Q-9858
 MIL-R-3065B
 MIL-W-16878

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-643
 MS33540
 MS33586
 Army Ballistic Missile Agency
 ABMA-STD-18
 ABMA-STD-41

3.3 Drawings:

Ordnance Corps - 10419947
 10509300
 10509302
 10509305
 10509311

EFFECTIVITY OF 10414055

VEHICLE	REVISIONS
SA-T	"A" Rev.
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev.
Spares	Before installing modify to latest configuration

SUMMARY SHEET

Nomenclature Valve, Fuel Control (Safety)

Drawing Numbers: 10414039,
20M30020

Vendor:

Saturn I Vehicle

Location: S-1 Stage

Estimated Design Life: 2,000 cy.

Failure Rate: $7,782 \times 10^{-6}/\text{cy.}$

MCBF (in cycles): 128.5

Total Number of Components
this Data Represents: 18

Total Cycles of Operation:
178

Total Number of
Failures Reported: 0

Vehicle Equipment: X
Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 through SA-5 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valve, Fuel Control (Safety)	
Drawing Numbers: 10414039	Vendor: NASA/MSFC
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 25,189 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 6 Number of Failures Reported: 0	MCBF (in cycles): 39.7 Total Cycles of Operation: 55 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 17 April 1961
PROCEDURE EP-140		PAGE 1 of 4
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414039 FUEL CONTAINER SAFETY VALVE ASSEMBLY		APPROVED <i>R. Paul</i>

1. DESCRIPTION.

The fuel container safety valve assembly 10414039 is a spring loaded poppet valve. It is used as a safety device to prevent overpressurization of the fuel container in the event a malfunction occurs in either of the solenoid operated pressurization valves or the vent valves. The valve assembly is installed on the 4-inch tube weldment in containers F2 and F4 as shown in the installation view. The various functional characteristics of the fuel container safety valve are as follows:

1.1 Operating Pressure and Venting Characteristics. When the fuel container is pressurized to 23 plus or minus 0.5 p.s.i.g. the safety valve starts venting. Venting is defined as a flow through the valve past the poppet seal of greater than 25 s.c.i.m. With a container pressure of 30 plus or minus 0.5 p.s.i.g. and a temperature of at least 50 degrees F. the valve vents at a rate of 2 plus or minus 0.1 pounds per second. The valve reseats at a minimum pressure of 20 p.s.i.g. Reseating is defined as a flow through the valve past the poppet seal of less than 25 s.c.i.m. The valve is capable of performing as follows:

- a. Operating temperature range: Minus 65° to plus 165° F.
- b. Leakage under 19 ± 0.5 p.s.i.g. pressure: External - no leakage allowed. Poppet housing plug - no leakage allowed.
- c. Proof operating pressure: 36 p.s.i.g.
- d. Burst pressure (without bursting): 60 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)

CAUTION: Paragraphs 1.2 and 1.3 constitute destructive test items that are performed only at the option of the procuring activity.

1.2 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.3 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

- 20 to 55 c.p.s. at three g's,
- 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
- 100 to 2,000 c.p.s. at 10 g's.

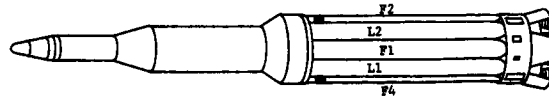
(Continued on page 4)

REVISION DATE
27 APR 1962

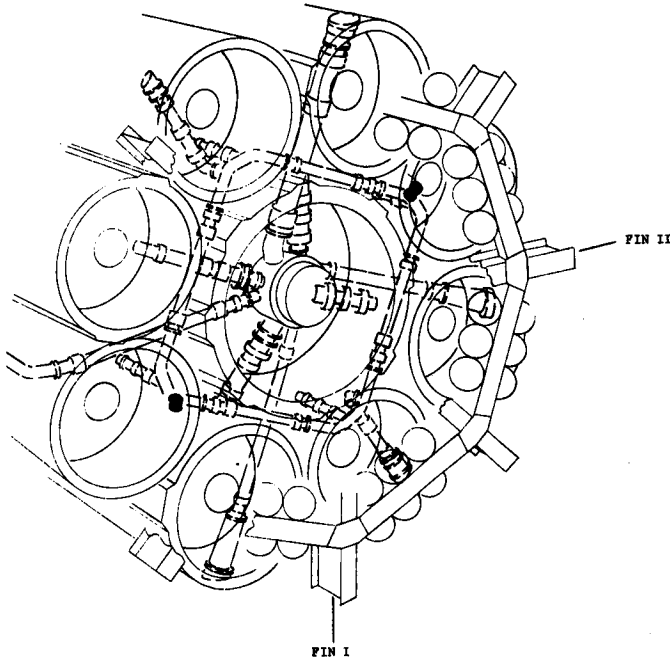
10414039

MSFC - Form 1151 (June 1961)

MANUFACTURING PLAN



GENERAL LOCATION



INSTALLATION VIEW - LOOKING AFT

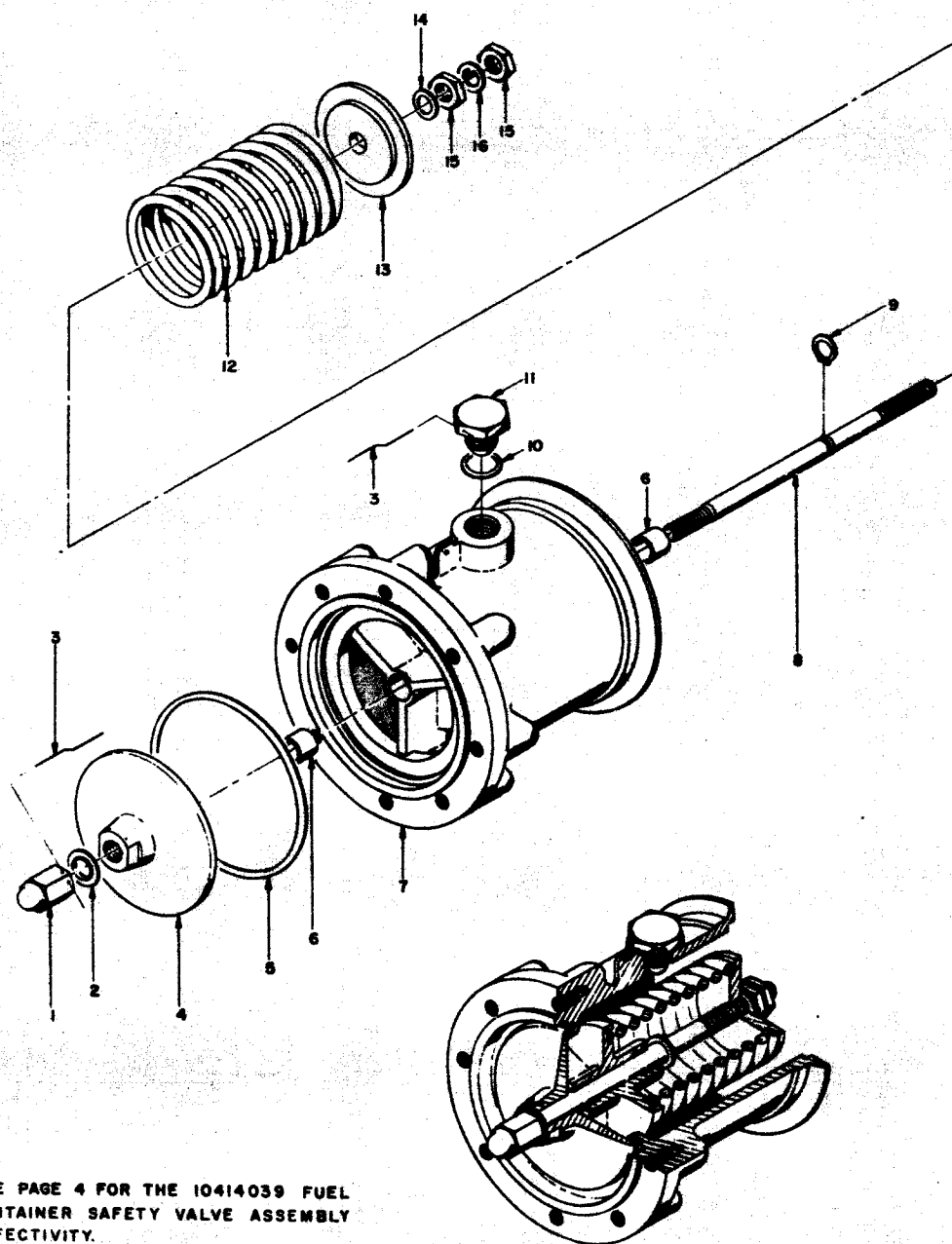
LEGEND

10414039	FUEL CONTAINER SAFETY VALVE ASSEMBLY ("C" REV. & EO-4)
1. 8945440	ACORN NUT (A)
2. 8940717	SEAL ("B" REV.) PRECISION RUBBER PRODUCTS CORP. 110 - 3/8 OR APPROVED EQUIVALENT (F)
3. MS20995C41	LOCKWIRE (C)
4. 8944235	POPPET ("A" REV.)
8945445	FUEL VENT VALVE POPPET HOUSING ASSEMBLY ("A" REV.) (AS MODIFIED BY NOTE 1, DWG. 10414039)
5. 8941740	POPPET HOUSING SEAL (H)
6. 8944062	BUSHING
7. 8945439	POPPET HOUSING (EO-1 & -2) (J) (K)
8. 8944201	SHAFT ("C" REV.) (F) (L)
9. MS9013-10	RETAINING RING
10. MS29512-8	PREFORMED PACKING (O-RING) (P) (Q)
11. AN814-8DL	SCREW THREAD PLUG AND BLEEDER (R)
12. 10414239	SPRING
13. 8944234	SPRING RETAINER
14. AN960C616	WASHER
15. MS35691-630	NUT (E)
16. 8941719	TAB WASHER

- NOTES
- CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
 - IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
 - PERMANENTLY MARK THE DATE OF ASSEMBLY. THE INSTALLATION DATE OF THE VALVE IN A VEHICLE SHALL NOT BE MORE THAN 24 MONTHS AFTER THE DATE OF ASSEMBLY.
 - TORQUE 100 TO 110 INCH-POUNDS.
 - LUBRICATE WITH DOW CORNING CORP. FLUOROSILICONE GREASE QC-2-0026 OR APPROVED EQUIVALENT.
 - LOCKWIRE IN ACCORDANCE WITH MS33540.
 - MOLD AND CURE IN PLACE (RUBBER, MIL-R-3065B, GRADE - SB-715, A₁B₁E₅ BUNA N).
 - RADIOGRAPHICALLY INSPECT IN ACCORDANCE WITH ARMA-STD-41.
 - HYDROSTATICALLY TEST CASTING AT 75 P.S.I.G. BOTH BEFORE AND AFTER MACHINING. PNEUMATICALLY TEST AT 25 P.S.I.G. UNDER WATER. THE APPEARANCE OF ANY BUBBLES DUE TO CASTING IMPERFECTIONS CONSTITUTES CAUSE FOR REJECTION.
 - MALCOMIZE AS REQUIRED.
 - OR APPROVED EQUIVALENT.
 - TORQUE 500 TO 700 INCH-POUNDS.

DRAWN BY:	<i>J. Rott</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414039	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. E. Bonner</i>		EO's -4.	
WRITER:	<i>G. E. Schreck</i>			
APPROVED BY:	<i>[Signature]</i>		RT CONTROL NO. M-F&AE-EP140-420-C	3 Nov 1961

MANUFACTURING PLAN

PROCEDURE
EP-140PAGE
3 of 4

NOTE: SEE PAGE 4 FOR THE 10414039 FUEL
CONTAINER SAFETY VALVE ASSEMBLY
EFFECTIVITY.

2. TEST AND DELIVERY REQUIREMENTS.

The acceptance test and the preparation for delivery of the valve is outlined in Performance Specification 10419923 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Federal - BB-N-411
Military - MIL-E-5272
MIL-L-25567
MIL-R-3065B

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile Agency
ABMA-STD-18
ABMA-STD-41

3.3 Drawings:

Ordnance Corps - 10419923
10509302
10509305
10509311

EFFECTIVITY OF 10414039

VEHICLE	REVISIONS
SA-T	"C" Rev. and EO-4
SA-1	"C" Rev. and EO-4
SA-2	"C" Rev. and EO-4
SA-3	"C" Rev. and EO-4
SA-4	"C" Rev. and EO-4
Spares	Before installing modify to latest configuration

10414039

REVISION DATE 3 NOV 1961

DATA SHEET	
Nomenclature: Valve, Fuel Control (Safety)	
Drawing Numbers: 20M30020	Vendor:
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 11,261 $\times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 12 Number of Failures Reported: 0	MCBF (in cycles): 88.8 Total Cycles of Operation: 123 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

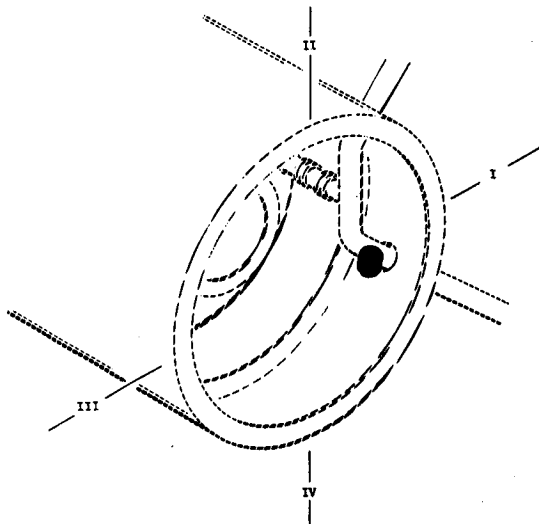
MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE 28 December 1961	PROCEDURE NO. MPI-2000
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30020 FUEL CONTAINER SAFETY VALVE ASSEMBLY				APPROVED <i>P. G. G. J.</i>	PAGE 1 OF 4
<p>1. DESCRIPTION.</p> <p>The fuel container safety valve assembly 20M30020 is a spring loaded poppet valve. It is used as a safety device to prevent overpressurization of the fuel container in the event a malfunction occurs in either of the solenoid operated pressurization valves or the vent valves. The valve assembly is installed on the 4-inch tube weldment in containers F1 and F2 as shown in the installation view. The various functional characteristics of the fuel container safety valve are as follows:</p> <p>1.1 Operating Pressure and Venting Characteristics. When the fuel container is pressurized to 23 plus or minus 0.5 p.s.i.g., the safety valve starts venting. Venting is defined as a flow past the poppet seal of greater than 25 s.c.i.m. With a container pressure of 30 plus or minus 0.5 p.s.i.g. and a temperature of at least 50 degrees F., the valve vents at a rate of 2 pounds per second minimum. The valve reseats at a minimum pressure of 20 p.s.i.g. Reseating is defined as a flow past the poppet seal of less than 25 s.c.i.m. The valve is capable of performing as follows:</p> <ul style="list-style-type: none"> a. Operating temperature range: -65° to +165° F. b. Leakage under 19 ± 0.5 p.s.i.g. pressure: External - no leakage allowed. Poppet housing plug: no leakage allowed. c. Proof operating pressure: 36 p.s.i.g. internal pneumatic pressure. d. Burst pressure (without bursting): 60 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.) e. Operating media: RP-1 fuel conforming to Specification MIL-R-25576, fuel vapor, air, helium, or gaseous nitrogen. <p style="margin-left: 40px;">CAUTION: Paragraphs 1.2 and 1.3 constitute destructive test items that are performed only at the option of the procuring activity.</p> <p>1.2 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:</p> <ul style="list-style-type: none"> 10-milliseconds duration - triangular wave, or 8-milliseconds duration - sine wave, or 6-milliseconds duration - square wave. <p>1.3 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:</p> <ul style="list-style-type: none"> 20 to 55 c.p.s. at three g's, 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and 100 to 2,000 c.p.s. at 10 g's. 					

(Continued on page 4)

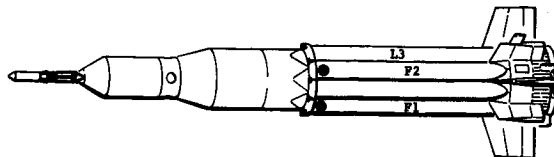
REVISION DATE
27 APR 1962

20M30020

MSFC - Form 1151 (June 1961)



INSTALLATION VIEW - LOOKING APT
(TYPICAL ON CONTAINERS F1 AND F2)



GENERAL LOCATION

== NOTES ==

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH MSFC-STD-103.
- (D) TORQUE 25 TO 30 INCH-POUNDS.
- (E) OR APPROVED EQUIVALENT.
- (F) LUBRICATE WITH DOW CORNING CORP. FLUOROSILICONE GREASE QC-2-0026, OR APPROVED EQUIVALENT.
- (G) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (H) MOLD AND CURE IN PLACE (RUBBER, MIL-R-3065B, GRADE - 8B-715, A₁B₁E₅ BUNA N).
- (J) RADIOGRAPHICALLY INSPECT IN ACCORDANCE WITH ARMA-STD-41.
- (K) HYDROSTATICALLY TEST MACHINED CASTING AT 100 P.S.I.G. PNEUMATICALLY TEST AT 100 P.S.I.G. UNDER WATER FOR 5 MINUTES. ANY APPEARANCE OF BUBBLES DUE TO CASTING IMPERFECTIONS CONSTITUTES CAUSE FOR REJECTION.
- (L) TORQUE 150 TO 250 INCH-POUNDS.
- (M) MALCOMIZE AS REQUIRED.
- (N) ADJUST RETAINER UNTIL POPPET OPENS AT 23 ± 0.5 P.S.I.G. AND CLOSURES AT A MINIMUM OF 20 P.S.I.G.
- (P) TORQUE 160 TO 190 INCH-POUNDS.

== LEGEND ==

20M30020		FUEL CONTAINER SAFETY VALVE ASSEMBLY (EO -2, -3, & -4) (A) (B) (C)
1.	20M30027	ACORN NUT (D)
2.	20M30035	SEAL (PRECISION RUBBER PRODUCTS CORP., 11Q-3/8) (E) (F)
3.	MS20995C41	LOCKWIRE (G)
4.	20M30026-2	DECAL
5.	20M30026-1	DECAL
6.	20M30010	POPPET (EO-1)
7.	20M30022	FUEL CONTAINER SAFETY VALVE HOUSING ASSEMBLY
7.1	20M30022-1	POPPET HOUSING SEAL (H)
7.2	20M30025	BUSHING
7.3	20M30021	POPPET HOUSING (EO-1) (MAKE FROM 20M30003) (I) (J)
8.	20M00420-8	K-SEAL (HARRISON MANUFACTURING CO., 12100CRB) (K)
9.	MC179D8W	SCREW THREAD PLUG AND BLEEDER (L)
10.	20M30017	SHAFT (M)
11.	20M30039	SPRING
12.	20M30216	SPRING RETAINER
13.	MS134357	BALL (11 PLACES)
14.	20M30215	RETAINER (N)
15.	20M30011	TAB WASHER
16.	MS33690-630	NUT (P)

DRAWN BY: <i>J. Bette</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30020	REVISION DATE OF THIS PAGE
PLANNER: <i>W. E. Bennett</i>		EO's: -2, -3, and -4	
WRITER: <i>B. P. Crawley</i>			
APPROVED BY: <i>M. J. J. J.</i>		ART CONTROL NO. M-ME-E-593-G	28 Jun 1963

MANUFACTURING PLAN

PROCEDURE

MPI-2000

PAGE

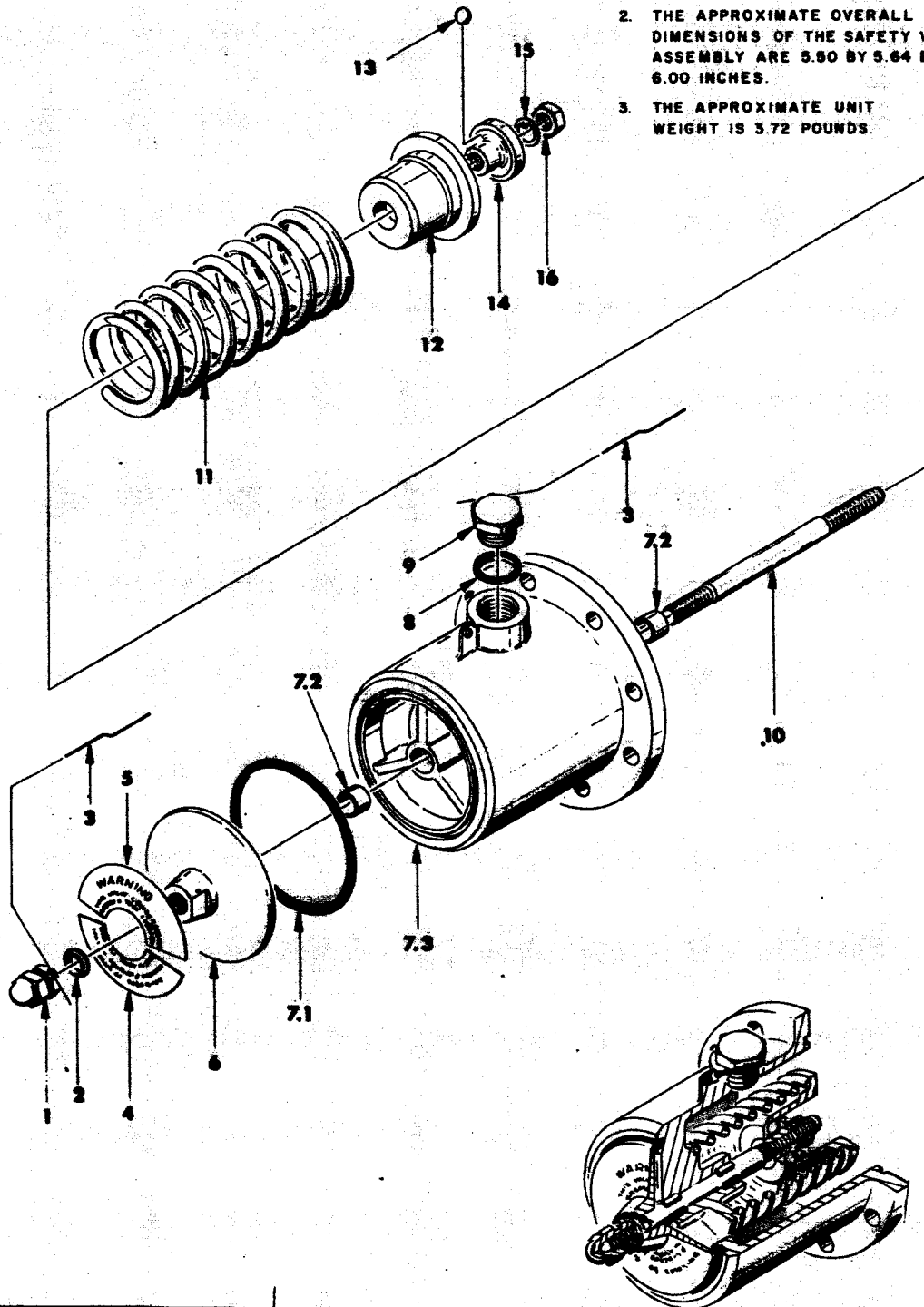
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OF

4

NOTES:

1. SEE PAGE 4 FOR THE 20M30020 FUEL CONTAINER SAFETY VALVE ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE SAFETY VALVE ASSEMBLY ARE 5.50 BY 5.64 BY 6.00 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 3.72 POUNDS.



REVISION DATE

M-ME-2000-593

20M30020

2. TEST AND DELIVERY REQUIREMENTS.

The acceptance test and the preparation for delivery of the valve is outlined in Performance Specification 10M01073 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
NASA - MSFC-SPEC-164

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile
Agency - ABMA-STD-18
ABMA-STD-41
NASA - MSFC-STD-105

3.3 Drawings:

Ordnance Corps - 10509302
MSFC - 10M01073

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	EO-2, -3, and -4
SA-6	EO-2, -3, and -4
SA-7	EO-2, -3, and -4
SA-8	Not Applicable
SA-9	EO-2, -3, and -4
SA-10	Not Applicable
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30020

REVISION DATE 28 June 1963

DATA SHEET	
Nomenclature: Switch, Level Limit (LOX)	
Drawing Numbers: 10414095	Vendor: Bendix
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $24,752 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 4 Number of Failures Reported: 0	MCBF (in cycles): 40.4 Total Cycles of Operation: 56 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE 28 November 1961
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414095 LOX LEVEL SWITCH AND CONNECTOR ASSEMBLY		PROCEDURE NO. EP-140
		APPROVED <i>P. R. [Signature]</i>
		PAGE 1 of 4

1. DESCRIPTION.

The LOX level switch and connector assembly 10414095 is a component of the LOX replenishing system. The assembly consists of a LOX level plate weldment 10414283, connector 10414248, and LOX level switch assembly 10414045. The switch assembly is used to prevent overflow of the LOX container during propellant tanking by automatically cutting off the filling operation when the liquid level in the LOX container reaches a predetermined level. The switch assembly incorporates a solenoid that is used to permit prechecking the switch assembly. The LOX level switch and connector assembly is located on the forward bulkhead of container LC as shown in the installation view. The various functional characteristics of the LOX level switch assembly 10414045 are as follows:

1.1 Mechanical Performance Characteristics. The switch assembly is capable of performing mechanically as follows:

- a. Operating pressure: 100 p.s.i.g. external pneumatic pressure.
- b. Proof operating pressure: 150 p.s.i.g. external pneumatic pressure.
- c. Burst pressure (without bursting): 250 p.s.i.g. external pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- d. Actuation and deactuation levels:
 - Actuation (rising fluid) - 2.20 inches from the top surface of the switch assembly.
 - Deactuation (falling fluid) - 2.43 inches from the top surface of the switch assembly.
- e. Operating temperature range: -320° to + 165° F.
- f. Service medium: LOX

1.2 Electrical Performance Requirements. The electrical performance requirements of the switch assembly are as follows:

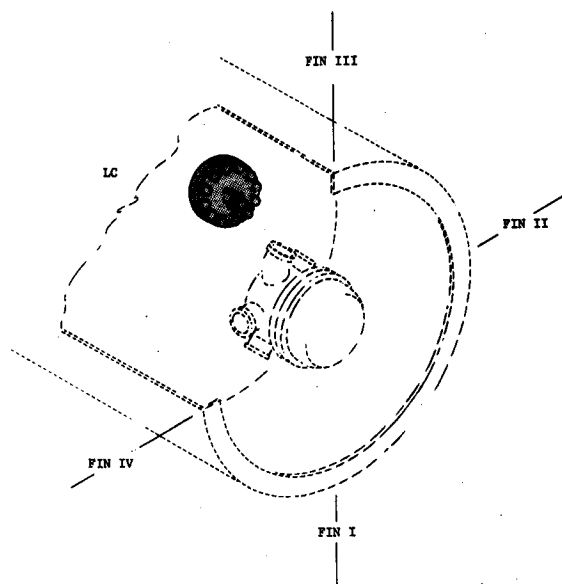
- a. Insulation resistance: 50 megohms minimum between each pin and the switch assembly case at 68° F.
- b. Precheck solenoid characteristics:
 - Resistance - 14 ± 2 ohms.
 - Nominal operating voltage - 28 v.d.c.
 - Maximum operating voltage - 32 v.d.c.
 - Pull-in voltage - 22 v.d.c. maximum
 - Drop-out voltage - 12 v.d.c. maximum, 1 v.d.c. minimum
- c. Level indication circuit characteristics:
 - Switch continuity between the low level contacts when operated with the precheck solenoid:
 - Deactuation - 0.5 ohm maximum
 - Actuation - 500,000 ohms minimum
 - Switch continuity between the high level contacts when operated with the precheck solenoid:
 - Deactuation - 500,000 ohms minimum
 - Actuation - 0.5 ohm maximum

NOTE: At no time may both high and low level indicators be "ON".

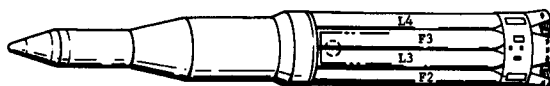
d. Electrical load: 0.5 a. inductive current at a rated voltage of 28 ± 2 v.d.c.

(Continued on Page 4)

10414095



INSTALLATION VIEW - LOOKING AFT



GENERAL LOCATION

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES, EXCEPT THE ALLPAX 500 GASKET, IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENT FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) OR APPROVED EQUIVALENT.
- (G) CLEAN IN ACCORDANCE WITH SPECIFICATION DRAWING 10438101.
- (H) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (J) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER FLANGE CONTACTS THE PLATE WELDMENT.
- (K) MAKE FROM AN924-10D IN ACCORDANCE WITH DRAWING 8942872.
- (L) TORQUE 1,000 TO 1,200 INCH-POUNDS.
- (M) SOLDER THE ELECTRICAL WIRING CONNECTIONS IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300.

LEGEND

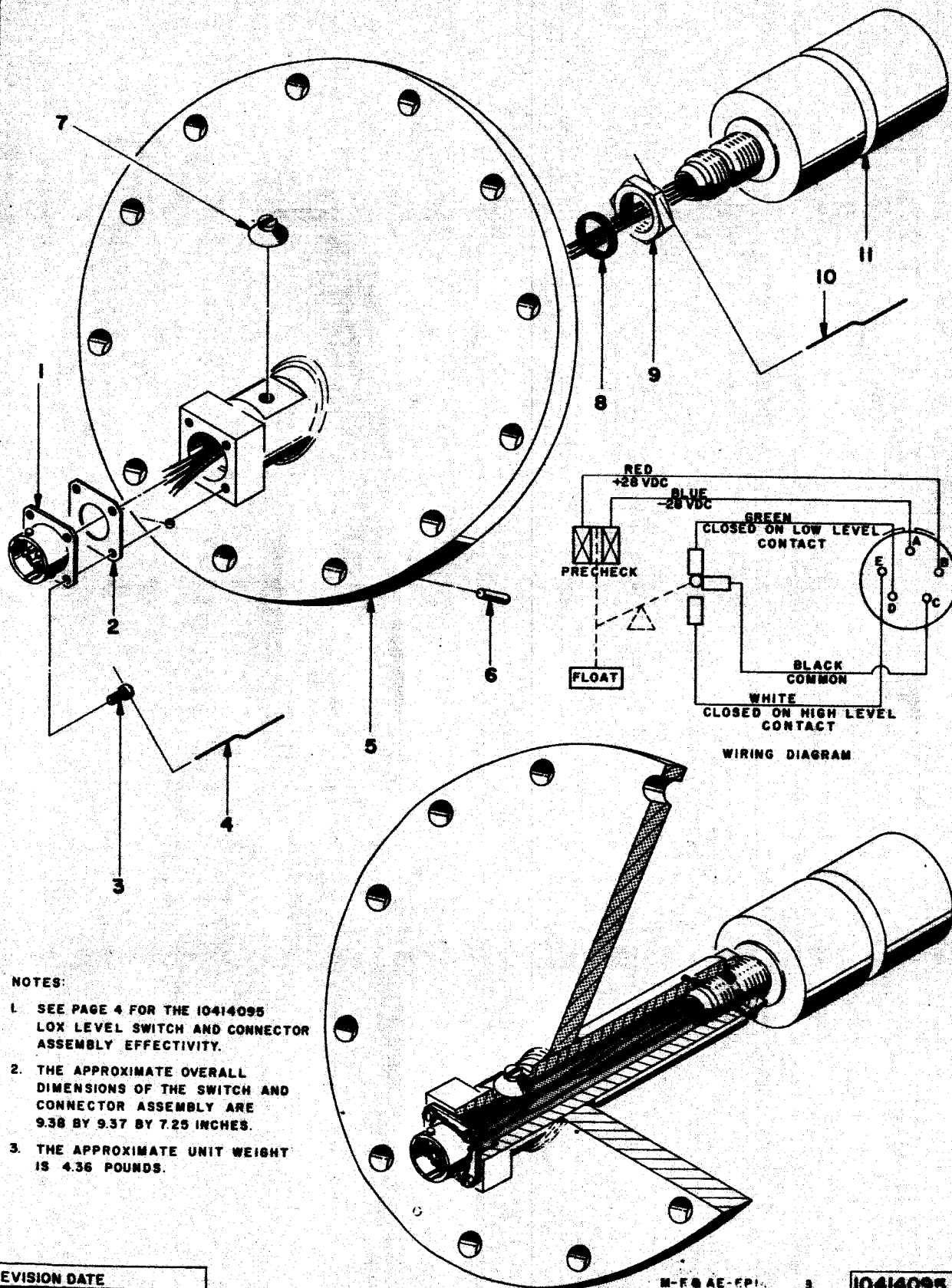
- 10414095 LOX LEVEL SWITCH AND CONNECTOR ASSEMBLY ("A" REV.) (A) (B) (C) (D) (E)
- 1. 10414248 CONNECTOR (BENDIX AVIATION CORP., SIDNEY, NEW YORK PTO2H-14-5P) (F)
- 2. 10414249 CONNECTOR GASKET (EO-1) (ALLPAX 500 MATERIAL) (G)
- 3. MS35276-15 SCREW (4 PLACES)
- 4. MS20995C20 LOCKWIRE (H)
- 5. 10414283 LOX LEVEL PLATE WELDMENT ("A" REV. & EO-2)
- 6. MS35672-34 GROOVED PIN
- 7. 10414267 VENT SEAL (J)
- 8. MS28778-10 PREFORMED PACKING (O-RING) (P)
- 9. 8942909 NUT (K) (L)
- 10. MS20995C41 LOCKWIRE (H)
- 11. 10414045 LOX LEVEL SWITCH ASSEMBLY ("B" REV.) (UNITED CONTROL CORP., 4540 UNION BAY PLACE, SEATTLE 5, WASHINGTON, 1093-1) (F) (M)

DRAWN BY:	<i>A. Bitt</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414095	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. C. Bennett</i>		EO's		
WRITER:	<i>G. E. Schump</i>				
APPROVED BY:	<i>W. H. Hightower</i>	A	CONTROL NO.	M-F&AE-EP140-498	

MANUFACTURING PLAN

PROCEDURE EP-140

PAGE 3 OF 4



REVISION DATE

MSFC - Form 1151-2 (June 1961)

M-FB AE-EPI

3

10414095

CAUTION: Paragraphs 1.3 through 1.6 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.3 Thermal Shock Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, immediate thermal shock from plus 70 degrees F. to minus 320 degrees F.
- 1.4 Shock Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:
 - 10-milliseconds duration - triangular wave, or
 - 8-milliseconds duration - sine wave, or
 - 6-milliseconds duration - square wave.
- 1.5 Submerged and Unsubmerged Operating Vibration Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, vibration from 10 to 500 c.p.s. for 5 minutes. The frequency cycle must be scanned twice in each of the three major axes under the following conditions:
 - 10 to 75 c.p.s. at 0.01-inch double amplitude displacement, and
 - 75 to 500 c.p.s. at 3 g's.
- 1.6 Unsubmerged Operating Vibration Withstanding Capability. The switch assembly is designed to withstand, without structural damage, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:
 - 20 to 55 c.p.s. at 3 g's,
 - 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 - 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the LOX level switch and connector assembly is outlined in Performance Specification 10419914 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106

3.2 Standards:

Military - MIL-STD-130
MS33540

3.3 Drawings:

Ordnance Corps - 10419914
10438101
10509300
10509302
10509305
10509311

Army Ballistic Missile Agency
ABMA-STD-18

EFFECTIVITY OF 10414095

VEHICLE	REVISIONS
SA-T	"A" Rev.
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev.
Spares	Re installing modify to latest configuration

10414095

DATA SHEET	
Nomenclature: Switch, Level Limit (Fuel)	
Drawing Numbers: 10414096	Vendor: Bendix
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 12,270 $\times 10^{-6}$ /cy. Number of Components this Data Represents: 5 Number of Failures Reported: 0	MCBF (in cycles): 81.5 Total Cycles of Operation: 113 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

II.16.2
Page 1 of 6

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA
MANUFACTURING PLAN		DATE 28 November 1961
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414096 FUEL LEVEL SWITCH AND CONNECTOR ASSEMBLY		PROCEDURE NO. EP-140
		APPROVED <i>P. Galt</i>
		PAGE 1 of 4

1. DESCRIPTION.

The fuel level switch and connector assembly 10414096 is a component of the fuel fill and drain system. The assembly consists of a fuel level plate weldment 10414280, connector 10414248, and fuel level switch assembly 10414047. The switch assembly acts to prevent overflow of the fuel container during propellant tanking by automatically cutting off the filling operation when the liquid level in the fuel container reaches a predetermined level. The switch assembly incorporates a solenoid that is used to permit prechecking the switch assembly. The fuel level switch and connector assembly is located on the forward bulkhead of container F2 as shown in the installation view. The various functional characteristics of the fuel level switch assembly 10414047 are as follows:

1.1 Mechanical Performance Characteristics. The switch assembly is capable of performing mechanically as follows:

- a. Operating pressure: 100 p.s.i.g. external pneumatic pressure.
- b. Proof operating pressure: 150 p.s.i.g. external pneumatic pressure.
- c. Burst pressure (without bursting): 250 p.s.i.g. external pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- d. Actuation and deactuation levels:
 - Actuation (rising fluid) - 1.83 inches from the top surface of the switch assembly.
 - Deactuation (falling fluid) - 2.06 inches from the top surface of the switch assembly.
- e. Operating temperature range: -320° to +165° F.
- f. Service medium: RP-1 fuel.

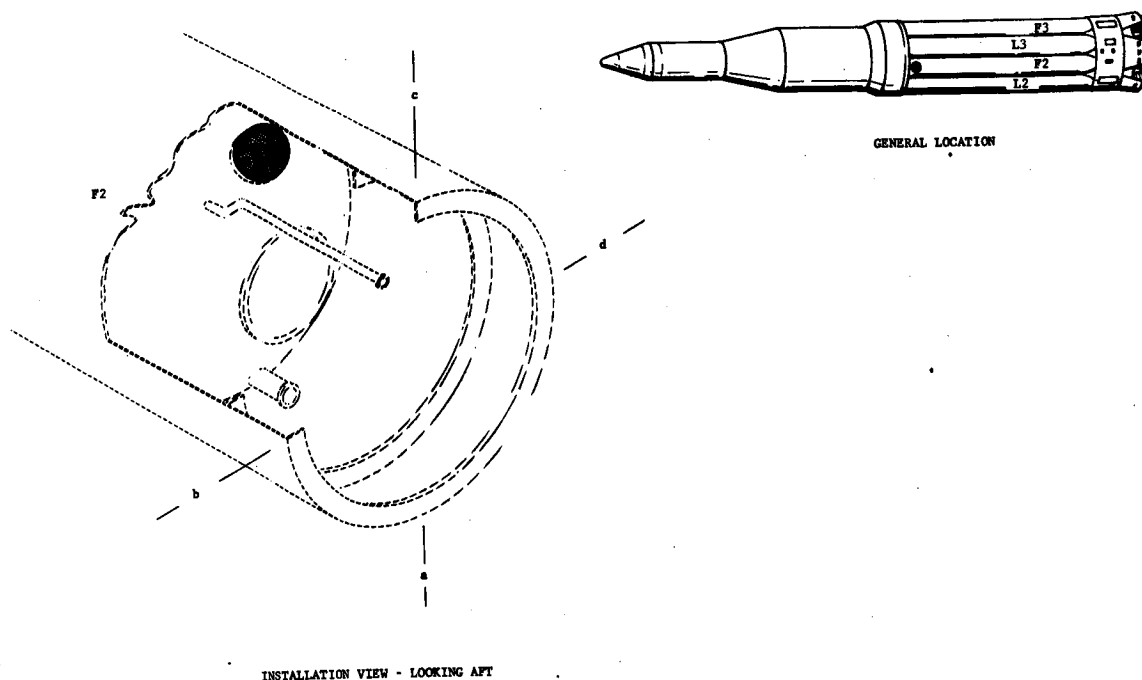
1.2 Electrical Performance Requirements. The electrical performance requirements of the switch assembly are as follows:

- a. Insulation resistance: 50 megohms minimum between each pin and the switch assembly case at 68° F.
- b. Precheck solenoid characteristics: Resistance - 14 ± 2 ohms.
 - Nominal operating voltage - 28 v.d.c.
 - Maximum operating voltage - 32 v.d.c.
 - Pull-in voltage - 22 v.d.c. maximum
 - Drop-out voltage - 12 v.d.c. maximum, 1 v.d.c. minimum
- c. Level indication circuit characteristics:
 - Switch continuity between the low level contacts when operated with the precheck solenoid:
 - Deactuation - 0.5 ohm maximum
 - Actuation - 500,000 ohms minimum
 - Switch continuity between the high level contacts when operated with the precheck solenoid:
 - Deactuation - 500,000 ohms minimum
 - Actuation - 0.5 ohm maximum
- d. Electrical load: 0.5 a. inductive current at a rated voltage of 28 ± 2 v.d.c.

NOTE: At no time may both high and low level indicators be "ON".

(Continued on Page 4)

MANUFACTURING PLAN



NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (E) OR APPROVED EQUIVALENT.
- (F) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (G) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER FLANGE CONTACTS THE PLATE WELDMENT.
- (H) MAKE FROM AN924-10D IN ACCORDANCE WITH DRAWING 8942872.
- (J) TORQUE 1,000 TO 1,200 INCH-POUNDS.
- (K) SOLDER THE ELECTRICAL WIRING CONNECTIONS IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300.

LEGEND

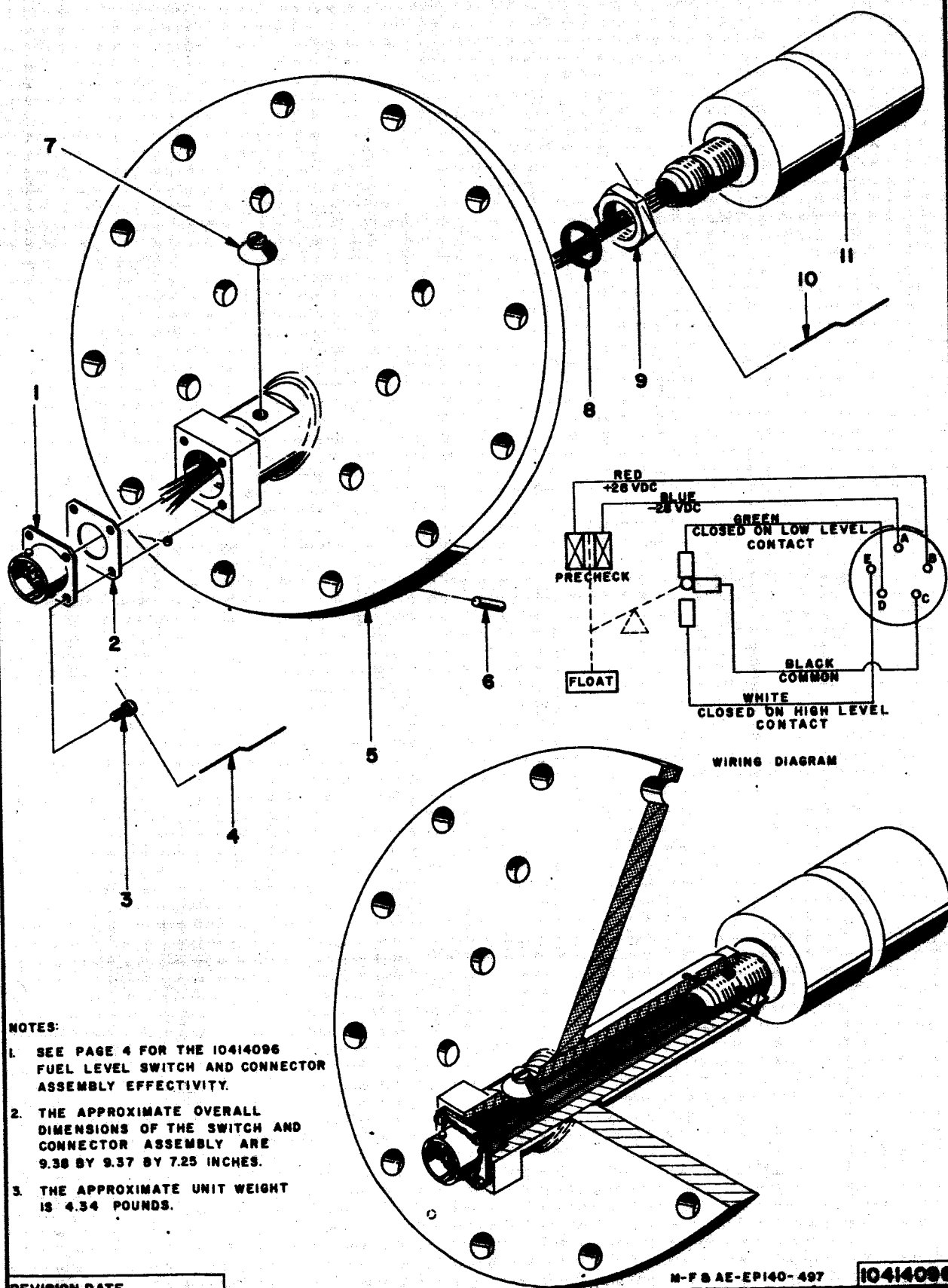
- | | |
|----------------|---|
| 10414096 | FUEL LEVEL SWITCH AND CONNECTOR ASSEMBLY ("A" REV.) (A) (B) (C) (D) |
| 1. 10414248 | CONNECTOR (BENDIX AVIATION CORP., SIDNEY, NEW YORK PT02H-14-5P) (E) |
| 2. 10414281 | CONNECTOR GASKET |
| 3. MS35276-15 | SCREW (4 PLACES) |
| 4. MS20995C20 | LOCKWIRE (F) |
| 5. 10414280 | FUEL LEVEL PLATE WELDMENT ("A" REV. & EO-2) |
| 6. MS35672-34 | GROOVED PIN |
| 7. 10414267 | VENT SEAL (G) |
| 8. MS28778-10 | PREFORMED PACKING (O-RING) (E) |
| 9. 8942909 | NUT (H) (I) |
| 10. MS20995C41 | LOCKWIRE (J) |
| 11. 10414047 | FUEL LEVEL SWITCH ASSEMBLY ("B" REV.) (UNITED CONTROL CORP., 4540 UNION BAY PLACE, SEATTLE 5, WASHINGTON, 1093-1) (K) (L) |

DRAWN BY: <i>J. B. B.</i>	ENGINEERING DRAWING RELEASE A	REVISION TO: 10414096	REVISION DATE OF THIS PAGE
PLANNER: <i>W. E. B.</i>		EO's	
WRITER: <i>G. E. J.</i>			
APPROVED BY: <i>M. H.</i>		ART CONTROL NO. M-F&AE-EP140-497	

MANUFACTURING PLAN

PROCEDURE EP-140

PAGE 3 OF 4



MANUFACTURING PLAN

CAUTION: Paragraphs 1.3 through 1.6 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.3 Thermal Shock Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, immediate thermal shock from plus 70 degrees F. to minus 320 degrees F.
- 1.4 Shock Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:
 10-milliseconds duration - triangular wave, or
 8-milliseconds duration - sine wave, or
 6-milliseconds duration - square wave.
- 1.5 Submerged and Unsubmerged Operating Vibration Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, vibration from 10 to 500 c.p.s. for 5 minutes. The frequency cycle must be scanned twice in each of the three major axes under the following conditions:
 10 to 75 c.p.s. at 0.01-inch double amplitude displacement, and
 75 to 500 c.p.s. at 3 g's.
- 1.6 Unsubmerged Operating Vibration Withstanding Capability. The switch assembly is designed to withstand, without structural damage, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:
 20 to 55 c.p.s. at 3 g's,
 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the fuel switch and connector assembly is outlined in Performance Specification 10419914 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Standards:

Military - MIL-STD-130
 MS33540
 Army Ballistic Missile Agency
 ABMA-STD-18

3.2 Drawings:

Ordnance Corps - 10419914
 10438101
 10509300
 10509302
 10509305
 10509311

EFFECTIVITY OF 10414096

VEHICLE	REVISIONS
SA-T	"A" Rev.
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev.
Spares	Before installing modify to latest configuration

10414096

DATA SHEET	
Nomenclature: Switch Assy, Limit	
Drawing Numbers: 10410747	Vendor: NASA/MSFC F-AE Div.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 1,686 x 10 ⁻⁶ /cy.	MCEF (in cycles): 593
Number of Components this Data Represents: 9	Total Cycles of Operation: 593
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 Vehicle only (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

SUMMARY SHEET	
Nomenclature Switch, OK, Low Pressure	
Drawing Numbers: 10414092, 20M30159	Vendor: MSFC and Southwestern Ind.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $4,128 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 30 Total Number of Failures Reported: 5	MCBF (in cycles): 242.2 Total Cycles of Operation: 1,211 Vehicle Equipment: X Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>3</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
<u>1</u>	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-7 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Switch, Low Pressure OK	
Drawing Numbers: 10414092	Vendor: Southwestern Ind.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $4,504 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 13 Number of Failures Reported: 2	MCBF (in cycles): 222 Total Cycles of Operation: 444 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		_____
	Would Not Close		
	Pressure:		
	None		
Low			
High			
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 10414092 component:

Two failures were reported on Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 18 May 1962
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414092 LOW PRESSURE SWITCH		PROCEDURE EP-140
APPROVED <i>P. Galt</i>		PAGE 1 of 4

1. DESCRIPTION.

The low pressure switch 10414092 is a single-pole, double throw low pressure OK switch that indicates both decreasing and increasing pressures within the range specified below. The switch is a component of the air bearing GN₂ supply system. One switch is used on the ST-90 and another on the ST-124 stabilized platform air bearing supply sphere assemblies. If the pressure in a sphere assembly drops to 1,375 ± 33 p.s.i.g. during standby operation, the switch shuts off the ST-90 or ST-124 stabilized platform and energizes the solenoid operated shutoff valve in the 10414077 pressure regulating valve. When the solenoid operated shutoff valve is energized (closed) the gaseous nitrogen flows through the bypass orifice of the pressure regulating valve at a reduced flow rate to permit runout of the ST-90 or ST-124 stabilized platform bearing. The switch is located on the air bearing GN₂ supply system high pressure sphere assemblies on the forward side of the spider beam on fin I and on the radial beam between fins III and IV as shown in the installation views: The various functional characteristics of the low pressure switch are as follows:

1.1 Mechanical Performance Characteristics. The switch is capable of performing mechanically as follows:

- a. Operating pressure: 3,100 p.s.i.g. internal pneumatic pressure.
- b. Proof operating pressure: 4,500 p.s.i.g. internal pneumatic pressure.
- c. Burst pressure (without rupture): 7,500 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
- d. Deactuating pressure (decreasing): 1,375 ± 33 p.s.i.g. to obtain continuity between electrical connector pins "A" and "B".
- e. Actuating pressure (increasing): The switch must actuate to obtain continuity between electrical connector pins "B" and "C".
- f. Differential pressure range between the decreasing pressure actuation point and increasing pressure actuation point: 70 p.s.i.g.
- g. Leakage with 2,135 p.s.i.g. maximum internal pneumatic pressure applied: None.
- h. Operating temperature range: -40° to +160° F.
- i. Operating media: Air, helium, or gaseous nitrogen.

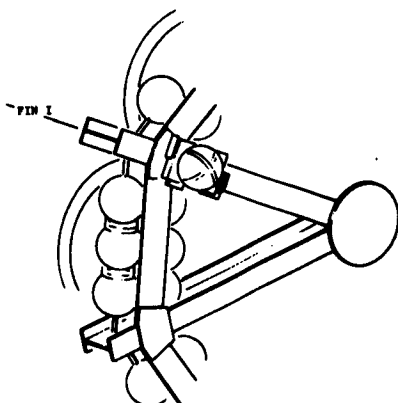
1.2 Electrical Performance Requirements. The electrical performance requirements of the switch are as follows:

- a. Insulation resistance (500 V. test): 50 megohms minimum between the electrical connector pins (circuit open) and between each pin and the switch case.
- b. Rating: 2.5 a. inductive load at 18 to 30 v.d.c.
- c. Continuity resistance: 0.5 ohm maximum between electrical connector pins "A" and "B" (circuit closed) and pins "B" and "C" (circuit closed). (NOTE: At no time shall both indicating circuits be open or closed at the same time.)

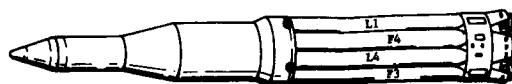
REVISION DATE

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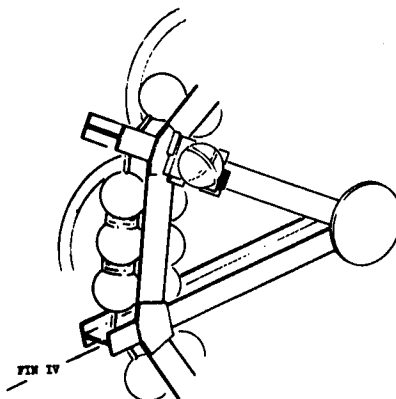
10414092



INSTALLATION VIEW - LOOKING AFT
(TYPICAL ON VEHICLES SA-3 & -4 ONLY)



GENERAL LOCATION



INSTALLATION VIEW - LOOKING AFT

NOTES

- A CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- B STAMP THE CURE DATE OF THE OLDEST PRE-FORMED PACKING RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- C IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- D OR APPROVED EQUIVALENT.
- E TORQUE 135 TO 150 INCH-POUNDS.
- F LUBRICATE WITH DOW-CORNING CORP. D.C.33 SILICONE GREASE OR APPROVED EQUIVALENT.
- G PACK RELIEF VENT WITH DOW-CORNING CORP. D.C.33 SILICONE GREASE OR APPROVED EQUIVALENT.
- H TORQUE 16 TO 20 INCH-POUNDS.
- I SOLDER ELECTRICAL CONNECTIONS IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300.
- J TORQUE 30 TO 40 INCH-POUNDS.
- K LOCKWIRE IN ACCORDANCE WITH MS33540.

LEGEND

- | | |
|---------------------|---|
| 10414092 | LOW PRESSURE SWITCH ("A" REV. EO-2 & -3)
(SOUTHWESTERN INDUSTRIES, INC., LOS ANGELES 65, CALIF., PS3800-D1375) |
| 1. 6421-1 | PISTON RETAINER (MADE FROM 7/16-20 x 3/8 STD. SCREW) |
| 2. 3800-1 | 1/16-INCH DIAMETER NYLON PELLET |
| 3. 3800-1 | PISTON |
| 4. 3800-1 | QUAD RING (3/16-INCH ID) |
| 5. 3800-1 | QUAD RING (3/16-INCH ID) |
| 6. 38-32 | NYLON LOCKED COVER SCREW (4 PLACES) |
| 7. 6454-1 | INLET FITTING |
| 8. MS29513-13 | PREFORMED PACKING (O-RING) |
| 9. 3815 | PISTON BALL (0.3125-INCH DIAMETER - STEEL) |
| 10. 3811-1 | SWITCH BALL (0.1250-INCH DIAMETER - STEEL) |
| 11. 6395 | PISTON BALL GUIDE |
| 12. 64-40 | SPRING SEAT |
| 13. 6471 | COMPRESSION SPRING |
| 14. 3812 | NYLON LOCKED COVER SCREW |
| 15. 3821 | NAMEPLATE |
| 16. 3821 | COVER PLATE GASKET |
| 17. 3821 | LOCK NUT (2 PLACES) |
| 18. 3825 | AUXILIARY ACTUATOR (MADE FROM MINNEAPOLIS HONEYWELL AUXILIARY ACTUATOR JS-18000) |
| 19. 18M1 | MILLI-SWITCH (MILLI-SWITCH CO. FRANKFORD, IND.) |
| 20. 3822-3 | SWITCH SHIM (FISHPAPER) |
| 21. 38-32 | SCREW |
| 22. 38-32 | SCREW |
| 23. 3824 | WASHER |
| 24. 3824 | SPECIAL WASHER |
| 25. 3803 | ADJUSTING PLATE |
| 26. 3585-040N x 1/4 | SCREW LOCKING INSERT (HELI-COIL) (2 PLACES) |
| 27. 6422 | ELECTRICAL WIRING |
| 28. 3819 | DOWEL PIN |
| 29. 3819 | THREADED STEEL INSERT |
| 30. 3819 | SPRING ADJUSTMENT SCREW (MADE FROM 1/4-28 NF x 1 1/4 STEEL STD. SOCKET HEAD SET SCREW, ANNEALED BEFORE MACHINING) |
| 31. 3819 | LOCKNUT (MADE FROM STD. 1/4-28 NF HEXAGON JAM NUT) |
| 32. 3819 | JAM NUT |
| 33. MS20995C32 | LOCKWIRE |
| 34. 6347 | ELECTRICAL CONNECTOR (CANNON GS02-10SL-3P-003) |
| 35. 3802 | ROLL PIN (TO FIT 0.046- TO 0.056-INCH DIAMETER HOLE) (3 PLACES) |
| 36. 3802 | MACHINED HOUSING (MADE FROM 3816 CASTING) |

DRAWN BY:	<i>J. R. R. R.</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414092	REVISION DATE OF THIS PAGE
PLANNER:	<i>John E. Bennett</i>	A	EO'S -2 and -3	26 Oct 1962
WRITER:	<i>G. E. Schramm</i>			
APPROVED BY:	<i>M. J. Schramm</i>		AP NTROL NO. M-ME-EP140-749-A	

DATA SHEET	
Nomenclature: Switch, Low Pressure OK	
Drawing Numbers: 20M30159	Vendor: Southwestern Industries
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $3,912 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 255.6
Number of Components this Data Represents: 17	Total Cycles of Operation: 767
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

II.17.1
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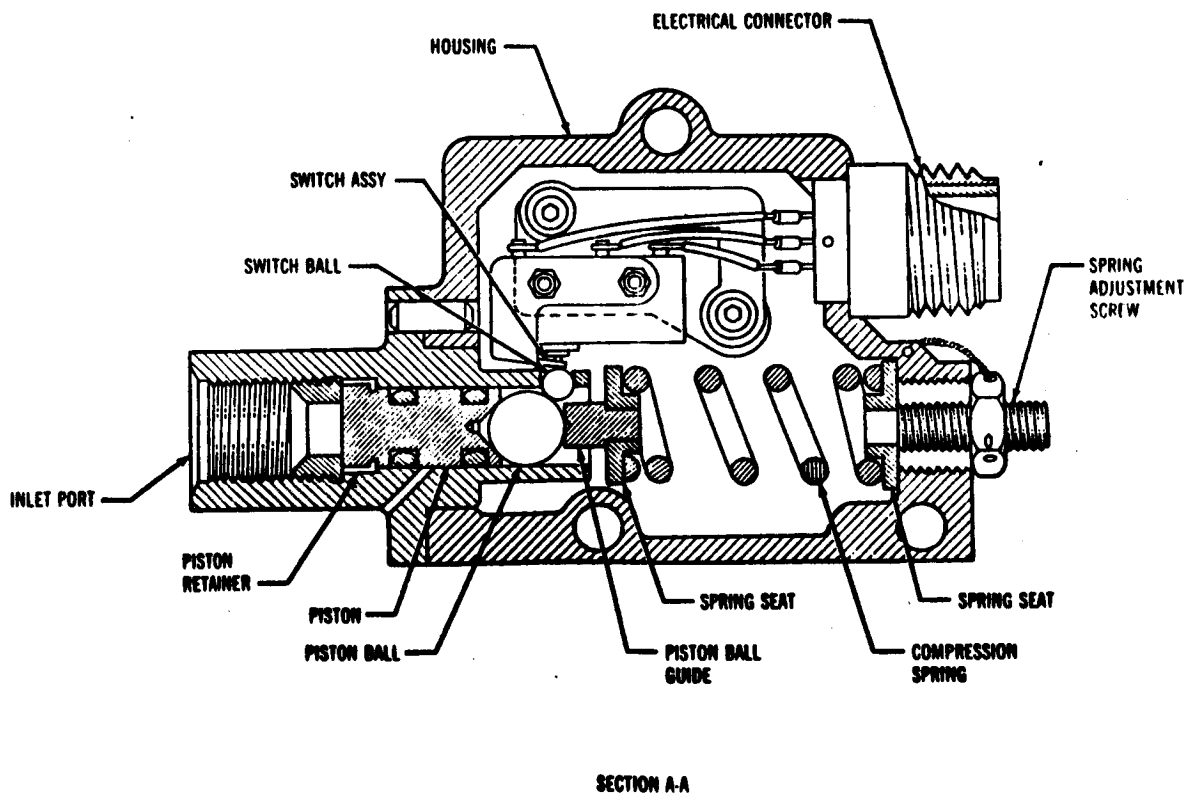
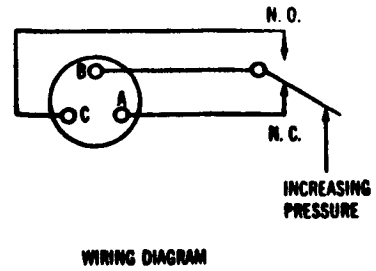
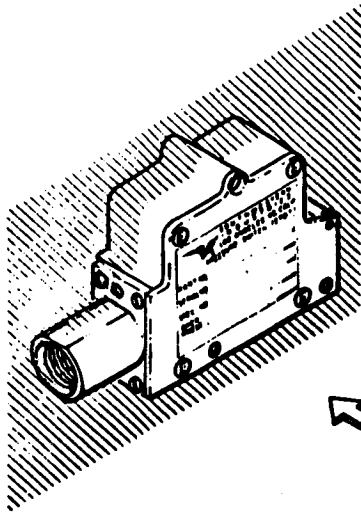
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>1</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
<u>1</u>	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-7 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30159 component:

The low-pressure switches shut down the stabilized platform and close a solenoid valve in the regulator assembly if the GN_2 pressure drops below approximately 1200 psig during standby operation.

1. Vendor - Southwestern Industries, Inc., Part No. PS3800-D1375
2. Location - Instrument unit high-pressure sphere assembly
3. Service - Air or GN_2
4. Temperature - Operating: -65 to 165°F
5. Pressure -
 - a. Operating: 3100 psig
 - b. Proof: 4650 psig
 - c. Burst: 7750 psig
 - d. Switch deactuating: 1375 \pm 33 psig
 - e. Switch actuating: 70 psig increase above deactuating pressure
6. Lubrication - Lubricate seals and sliding surfaces with DC-55 grease (Dow Corning)
7. Electrical Characteristics -
 - a. Insulation resistance: 50 megohms minimum between terminal and switch case
 - b. Circuit resistance: 0.5 ohm maximum between connector pins A and B and B and C when circuit is fully open.

Three failures were reported on Inspection Reports.



LOW-PRESSURE SWITCH, 20M30159 - SECTIONAL VIEW

SUMMARY SHEET	
Nomenclature Switch, Control Pressure, (Fuel)	
Drawing Numbers: 10414338, 20M30184	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $2,433 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 22 Total Number of Failures Reported: 2	MCBF (in cycles): 411 Total Cycles of Operation: 822 Vehicle Equipment: X Ground Equipment:

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-9 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Switch, Control Pressure (Fuel)	
Drawing Numbers: 10414338	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $7,491 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 133.5
Number of Components this Data Represents: 13	Total Cycles of Operation: 267
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		PROCEDURE
DATE		EP-140
5 April 1962		PAGE
APPROVED		1 of 4
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414338 FUEL CONTAINER PRESSURE SWITCH		<i>A. Gault</i>

1. DESCRIPTION.

The fuel container pressure switch 10414338 is an electrically operated pre-set pressure switch designed to indicate the presence of a predetermined head pressure in the fuel containers. The pressure switch is used to activate fuel container pressurization valves 10414308 for proper pressurization of the fuel containers. The pressure switch is a component of the fuel container pressurization system. The pressure switch is located in the forward skirt of fuel container F1 as shown in the installation view. The various functional characteristics of the pressure switch are as follows:

1.1 Operating Characteristics. The operating characteristics of the pressure switch are as follows:

- a. Operating media: Air, RP-1 vapor, or gaseous nitrogen.
- b. Operating temperature range: -65° to $+165^{\circ}$ F. with a maximum ± 0.3 p.s.i.g. actuation deviation.
- c. Pressure setting range: 10 to 100 p.s.i.g.
- d. Maximum operating pressure: 40 p.s.i.g. internal pneumatic pressure.
- e. Proof pressure: 150 p.s.i.g. maximum for 5 minutes.
- f. Burst pressure (without bursting): 450 p.s.i.g. minimum.
(CAUTION: Use only for destructive acceptance testing.)
- g. Vacuum withstanding capability: Vacuum atmosphere equivalent to 80,000 feet altitude without failure or impairment of performance.
- h. Venting rate: 0.5 p.s.i.g. per second (atmospheric pressure portion of the switch)

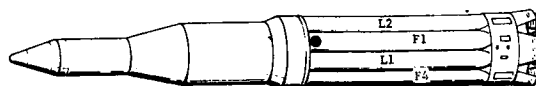
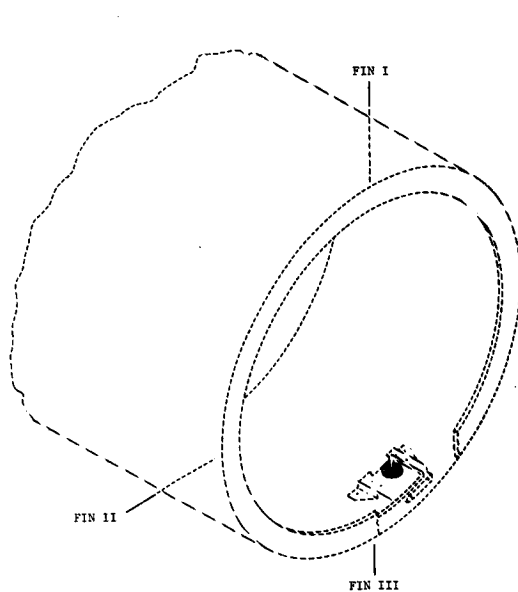
1.2 Electrical Performance Requirements. The electrical performance requirements of the pressure switch are as follows:

- a. Operating voltage: 18 to 30 v.d.c.
- b. Electrical switch: Single pole, double throw, 3 a. resistive load at 28 v.d.c.
CAUTION: The maximum resistive load applied to the pressure switch during fabrication or testing must not be greater than 0.5 a.
- c. Contact resistance: 0.5 ohm maximum between pins "A" and "B" (circuit closed) and pins "B" and "C" (circuit closed).
- d. Insulation resistance: 50 megohm minimum between each connector pin and the switch body.
- e. Contact performance: Must not resonate or chatter when subjected to 1,500 c.p.s. vibration at 20 g's parallel to the switch operational axis.
- f. Actuation pressure:
 - 1 Nonvibration conditions - Second and succeeding cycles - 17 ± 0.3 p.s.i.g. on increasing pressure and $80^{\circ} \pm 20^{\circ}$ F.; first cycle - ± 0.2 p.s.i.g. of second and succeeding cycles.
 - 2 Vibration conditions - 17 ± 0.5 p.s.i.g. on increasing pressure and $80^{\circ} \pm 20^{\circ}$ F.
- g. Deactuation pressure:
 - 1 Nonvibration conditions: On decreasing pressure a minimum of 0.5 p.s.i.g. and a maximum of 2.0 p.s.i.g. differential

REVISION DATE

(Continued on page 4)

10414338



GENERAL LOCATION

LEGEND

FUEL CONTAINER PRESSURE SWITCH
 ("A" REV. & EO-2) (FREBANK CO. 4188-1)

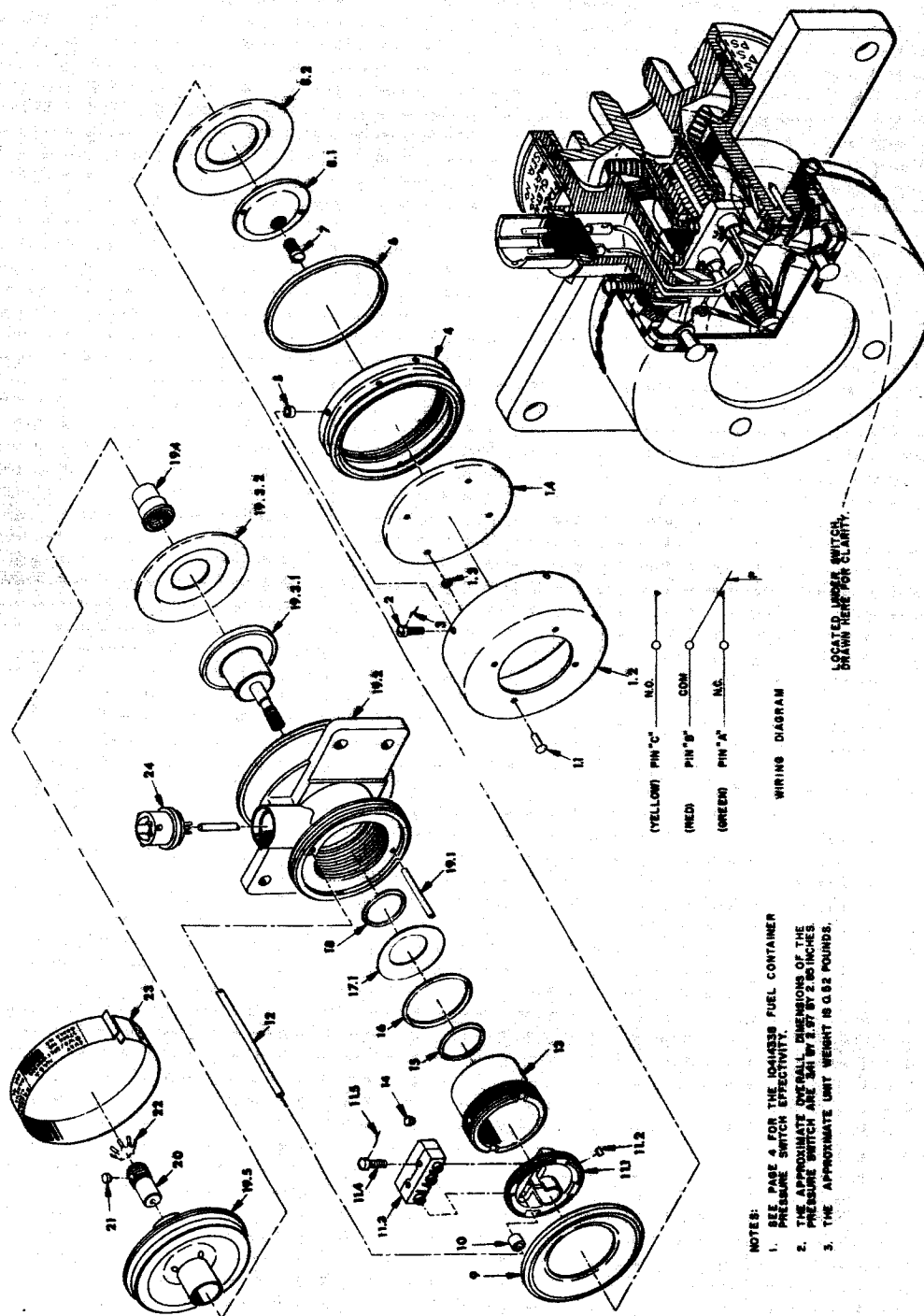
- | | | |
|--------|--------------|--|
| 1. | 4281-1 | SHIELD ASSEMBLY |
| 1.1 | AN470A3-4 | RIVET (4 PLACES) (P) |
| 1.2 | 4284 | SHIELD |
| 1.3 | 4282 | SPACER (2 PLACES) |
| 1.4 | 4283 | COVER |
| 2. | AN500AD2-3 | SCREW (4 PLACES) (C) |
| 3. | MS20995C20 | LOCKWIRE (H) |
| 4. | 4274 | SEALING RING (J) (K) |
| 5. | 4272 | SPACER (4 PLACES) |
| 6. | 4271 | LOCATING RING |
| 7. | AN565DBH2 | SCREW (H) (N) |
| 8. | 4286 | DIAPHRAGM PLATE ASSEMBLY |
| 8.1 | 4288-4 | DIAPHRAGM PLATE |
| 8.2 | 4287-2 | L. P. DIAPHRAGM (N) |
| 9. | 4273 | CENTERING RING |
| 10. | 3885-3 | INSULATION SLEEVE (3 PLACES) |
| 11. | 4289-1 | ELECTRICAL ASSEMBLY |
| 11.1 | 4290-2 | SWITCH BRACKET |
| 11.2 | 2869 | LOCK PLUG (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D) |
| 11.3 | 4258-4 | SUBMINIATURE SWITCH (MADE FROM HAYDON SWITCH CORP. SWITCH NO. 53820-2) (D) |
| 11.4 | 4259 | MACHINE SCREW (WITH KEL-F INSERT) (MADE FROM LONG-LOK CORP. LL500A2-7) (2 PLACES) (D) (P) (N) |
| 11.5 | MS20995C20 | LOCKWIRE (H) |
| 12. | 4202-()-() | ELECTRICAL WIRE (HIGH TEMPERATURE) (3 PLACES) (S) |
| 13. | 4267-5 | ADJUSTMENT RING (S) |
| 14. | 2869 | LOCK PLUG (2 PLACES) (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D) |
| 15. | 4674 | BELLEVILLE SPACER RING (INNER) (4 PLACES) |
| 16. | 4675 | BELLEVILLE SPACER RING (OUTER) (3 PLACES) |
| 17. | 4544 | BELLEVILLE SPRING ASSEMBLY |
| 17.1 | 3910 | BELLEVILLE SPRING (4 PLACES) (U) |
| 18. | 4674 | BELLEVILLE SPACER RING (INNER) (U) |
| 19. | 4295-1 | BODY ASSEMBLY |
| 19.1 | 4256 | CAPILLARY TUBE (V) |
| 19.2 | 4298 | MACHINED BODY |
| 19.3 | 4300-1 | SHAFT DIAPHRAGM ASSEMBLY |
| 19.3.1 | 4301-4 | ACTUATION SHAFT |
| 19.3.2 | 4287-1 | L. P. DIAPHRAGM |
| 19.4 | 4297-3 | COMPENSATION RING (V) |
| 19.5 | 4296 | END FITTING (S) (V) |
| 20. | 4255-3 | STOP SCREW (D) |
| 21. | 2021 | LOCK PLUG (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D) |
| 22. | 4280 | SPRING |
| 23. | 4294-4 | NAMEPLATE |
| 24. | 4537-8-3P | SOLDER MOUNT RECEPTACLE (BENDIX AVIATION CORP. - PYGMY TYPE) (D) |

- NOTES
- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
 - (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - (C) STAMP THE CURE DATE OF OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
 - (D) OR APPROVED EQUIVALENT.
 - (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
 - (F) RIVET ITEMS 1.2, 1.3, AND 1.4 TOGETHER AS SHOWN.
 - (G) TORQUE 6 TO 8 INCH-POUNDS.
 - (H) LOCKWIRE IN ACCORDANCE WITH MS33540.
 - (J) TORQUE 900 TO 1,200 INCH-POUNDS.
 - (K) SOLDER TO BODY (19.2) IN ACCORDANCE WITH SPECIFICATION MIL-S-6872 USING QQ-S-571C/SN60.
 - (L) TORQUE 40 TO 60 INCH-POUNDS.
 - (M) SEAL INTO DIAPHRAGM ASSEMBLY (8) IN ACCORDANCE WITH SPECIFICATION MIL-S-6872 USING QQ-S-571C/SN60.
 - (N) SOLDER TO PLATE (8.1) IN ACCORDANCE WITH SPECIFICATION MIL-S-6872 USING QQ-S-571C/SN60.
 - (P) TORQUE 60 TO 85 INCH-POUNDS.
 - (Q) KEL-F INSERT INSTALLED BY LONG-KOL CORP.
 - (R) SOLDER THE ELECTRICAL WIRES 4402-1-14 (RED), 4402-2-14 (YELLOW), AND 4402-3-14 (GREEN) TO THE SUBMINIATURE SWITCH IN ACCORDANCE WITH THE WIRING DIAGRAM.
 - (S) TORQUE 600 TO 900 INCH-POUNDS.
 - (T) A COMBINATION OF APPROXIMATELY FOUR SPRINGS (TWO 3910-2 AND TWO 3910-4) GIVES THE REQUIRED INCREASING SNAP LOAD OF 76 ± 1 POUNDS AND DECREASING SNAP LOAD OF 26 ± 1 POUNDS.

NOTES (CON.)

- (U) PART OF FOUR INNER RINGS REQUIRED IN CALLOUT 15. READING FROM RIGHT TO LEFT, CALLOUTS 18, 17.1, 16, AND 15 ARE SHOWN IN SEQUENCE OF INSTALLATION AS INNER RING, SPRING, OUTER RING, INNER RING, AND SO ON UNTIL REQUIRED NUMBER OF EACH IS INSTALLED.
- (V) SOLDER TO BODY (19.2) AND FREE END IN ACCORDANCE WITH SPECIFICATION MIL-S-6872 USING QQ-S-571C/SN60.
- (W) SOLDER TO END FITTING (19.5) IN ACCORDANCE WITH SPECIFICATION MIL-S-6872 USING QQ-S-571C/SN60.
- (X) TORQUE 960 TO 1,080 INCH-POUNDS.
- (Y) SOLDER END FITTING (19.5) TO BODY (19.2) THROUGH HOLES IN 19.2 IN ACCORDANCE WITH SPECIFICATION MIL-S-6872 USING QQ-S-571C/SN60.

DRAWN BY:	<i>E. Dennis</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414338	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. E. Bennett</i>		EO'S	-2	
WRITER:	<i>L. J. Allen</i>		ART CONTROL NO.	M-ME-EP140-748	
APPROVED BY:	<i>M. V. Heston</i>				



- NOTES:
1. SEE PART 4 FOR THE 1044388 FUEL CONTAINER PRESSURE SWITCH EFFECTIVITY.
 2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ARE 3.41 BY 2.97 BY 2.80 INCHES.
 3. THE APPROXIMATE UNIT WEIGHT IS 0.52 POUNDS.

1.2 (Con.)

pressure from the pressure noted in par. 1.2, step f.1.
2 Vibration conditions: On decreasing pressure a minimum of 0.3 p.s.i.g. and a maximum of 3.5 p.s.i.g. differential pressure from the pressure noted in par. 1.2, step f.2.

h. The wiring diagram is shown on page 3.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The pressure switch is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The pressure switch is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

- 20 to 55 c.p.s. at 3 g's,
- 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
- 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the pressure switch are outlined in Performance Specification 10419936 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications.

Military - MIL-E-5272
 MIL-Q-9858
 MIL-S-6872

3.3 Drawings.

Ordnance Corps - 10419909
 10419936
 10415300
 10415302
 10415305
 10415311

3.2 Standards.

Military - MIL-STD-130
 MIL-STD-643
 MS33540
 MS33586

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"A" Rev.
SA-1	"A" Rev. and EO-2
SA-2	"A" Rev. and EO-2
SA-3	"A" Rev. and EO-2
SA-4	"A" Rev. and EO-2
SPARES	Before installing modify to latest configuration

10414338

REVISION DATE

DATA SHEET	
Nomenclature: Switch, Control Pressure (Fuel)	
Drawing Numbers: 20M30184	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $2,496 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 400.7
Number of Components this Data Represents: 9	Total Cycles of Operation: 555
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

II.17.2
Page 9 of 15

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30184 FUEL CONTAINER PRESSURE SWITCH				27 September 1962	MP1-2000
APPROVED <i>P. G. Giff</i>				PAGE 1 of 4	

1. DESCRIPTION.

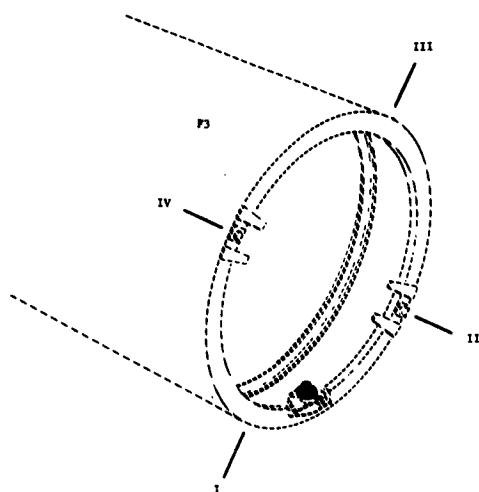
The fuel container pressure switch 20M30184 is a pneumatically operated pressure switch that indicates electrically at a predetermined pressure. The pressure switch is a component of the fuel tank pressurization system. After initial fuel tank pressurization, a constant pressure is maintained in the fuel container by electrical signals from the pressure switch to one, two, or three fuel container pressurizing control valves 20M30171. The number of pressurizing control valves cut in or out of the pressure switch electrical circuit at a given time during flight is controlled by programed tape to compensate for vehicle acceleration and pressure decay in the high pressure spheres. The pressure switch is located in the forward skirt of container F3 as shown in the installation view. The various functional characteristics of the pressure switch are as follows:

- 1.1 Operating Characteristics. The operating characteristics of the pressure switch are as follows:
- Operating media: Air, RP-1 fuel vapor conforming to MIL-R-25576, or gaseous nitrogen.
 - Operating temperature range: -65° to $+165^{\circ}$ F.
 - Indicating pressure setting: Factory adjustable.
 - Operating pressure: 40 p.s.i.g. minimum internal pneumatic pressure.
 - Proof pressure: 150 p.s.i.g. minimum internal pneumatic pressure.
 - Burst pressure (without bursting): 450 p.s.i.g. minimum internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
 - Venting requirement: The atmospheric portion must be adequately vented to prevent changing external pressures from affecting operation.
 - Vacuum withstanding capability: 0 to $+0.5$ p.s.i.a.
 - Room temperature nonvibration actuation pressure (increasing) setting: 17 ± 0.3 p.s.i.g. on the second and succeeding cycles of operation at room temperature ($77^{\circ} \pm 18^{\circ}$ F.) (possess continuity between connector pins "B" and "C"). The actual pressure of the first actuation must be within ± 0.2 p.s.i. of the pressure obtained on the second or succeeding cycles of operation.
 - Room temperature nonvibration deactuation pressure (decreasing) setting: 0.5 minimum to 2 p.s.i.d. maximum of the actual actuation pressure (possess continuity between connector pins "A" and "B").
 - High and low temperature nonvibration actuation pressure setting: Within ± 0.3 p.s.i. of the actual actuation pressure obtained in step i. on the second and succeeding cycles of operation at high or low temperatures (-65° to $+59^{\circ}$ F. or $+95^{\circ}$ to $+165^{\circ}$ F.). The actual pressure of the first actuation must be within ± 0.2 p.s.i. of the second and succeeding cycles of operation.

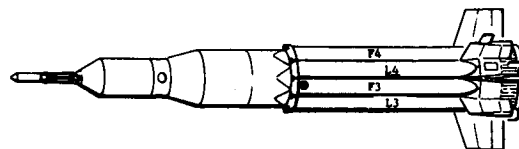
REVISION DATE

(Continued on page 4)

20M30184



INSTALLATION VIEW - LOOKING AFT



GENERAL LOCATION

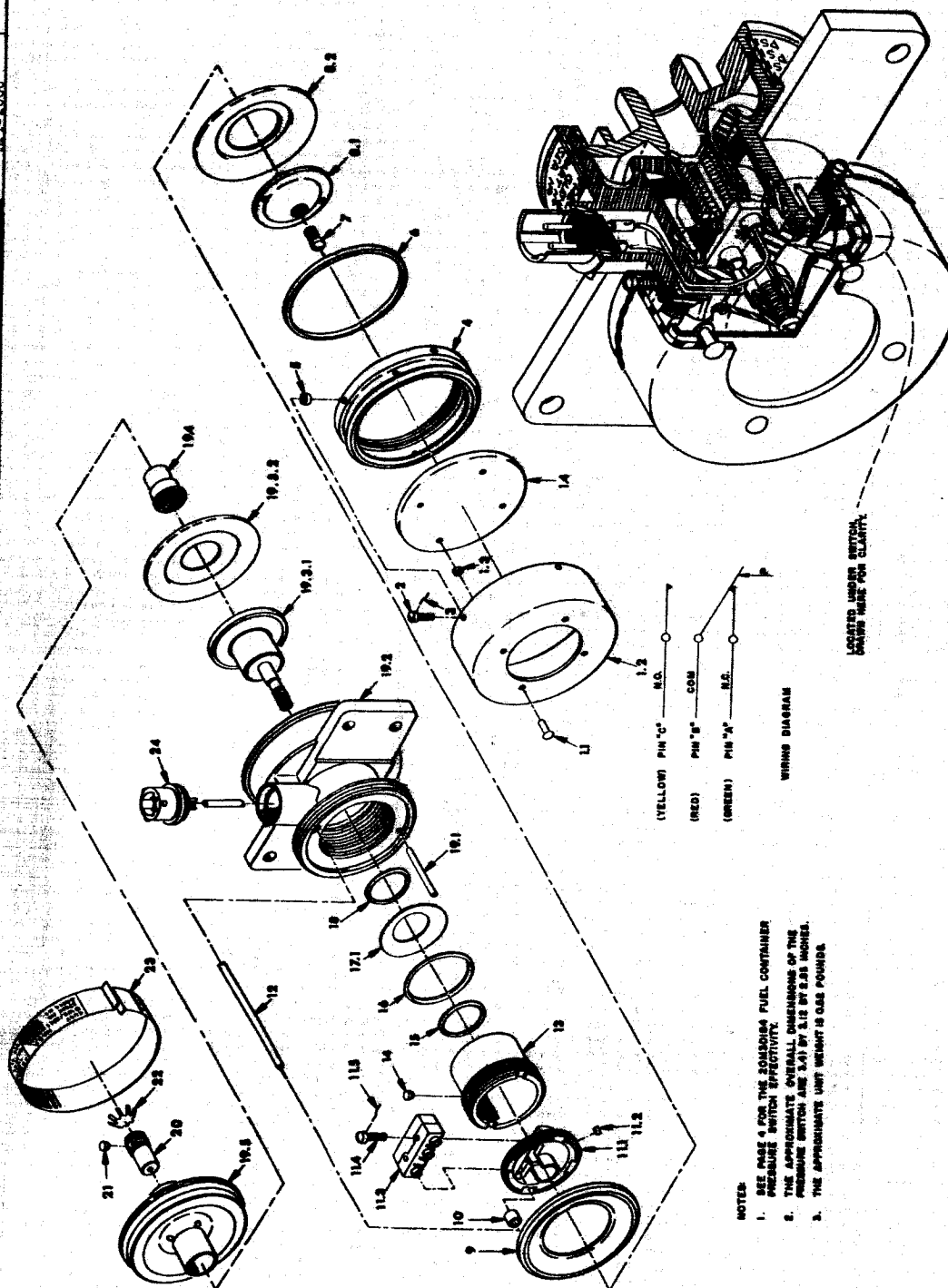
- NOTES**
- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH NSFC-SPEC-164.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (D) OR APPROVED EQUIVALENT.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) RIVET ITEMS 1.2, 1.3, AND 1.4 TOGETHER AS SHOWN.
- (G) TORQUE 6 TO 8 INCH-POUNDS.
- (H) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (J) TORQUE 900 TO 1,200 INCH-POUNDS.
- (K) SOLDER TO BODY (19.2) IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SM60.
- (L) TORQUE 40 TO 60 INCH-POUNDS.
- (M) SEAL INTO DIAPHRAGM ASSEMBLY (8) IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SM60.
- (N) SOLDER TO PLATE (8.1) IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SM60.
- (P) TORQUE 60 TO 85 INCH-POUNDS.
- (Q) KEL-F INSERT INSTALLED BY LONG-KOL CORP.
- (R) SOLDER THE ELECTRICAL WIRES 4402-1-14 (RED), 4402-2-14 (YELLOW), AND 4402-3-14 (GREEN) TO THE SUBMINIATURE SWITCH IN ACCORDANCE WITH THE WIRING DIAGRAM.

- NOTES (CONT)**
- (S) TORQUE 600 TO 900 INCH-POUNDS.
- (T) A COMBINATION OF APPROXIMATELY FOUR SPRINGS (TWO 3910-2 & TWO 3910-4) GIVES THE REQUIRED INCREASING SNAP LOAD OF 76 ± 1 POUNDS AND DECREASING SNAP LOAD OF 26 ± 1 POUNDS.
- (U) PART OF FOUR INNER RINGS REQUIRED IN CALLOUT 15, READING FROM RIGHT TO LEFT, CALLOUTS 18, 17.1, 16, AND 15 ARE SHOWN IN SEQUENCE OF INSTALLATION AS INNER RING, SPRING, OUTER RING, INNER RING, AND SO ON UNTIL REQUIRED NUMBER OF EACH IS INSTALLED.
- (V) SOLDER TO BODY (19.2) AND FREE END IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SM60.
- (W) SOLDER TO END FITTING (19.3) IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SM60.
- (X) TORQUE 960 TO 1,080 INCH-POUNDS.
- (Y) SOLDER END FITTING (19.3) TO BODY (19.2) THROUGH HOLES IN 19.2 IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SM60.

- 20M30184
1. 4281-1
 - 1.1 AN470A3-4
 - 1.2 4284
 - 1.3 4282
 - 1.4 4283
 2. AN300AD2-3
 3. MS20995C20
 4. 4274
 5. 4272
 6. 4271
 7. AN565DBH2
 8. 4286
 - 8.1 4288-4
 - 8.2 4287-2
 9. 4273
 10. 3885-3
 11. 4289-1
 - 11.1 4290-2
 - 11.2 2869
 - 11.3 4258-4
 - 11.4 4259
 - 11.5 MS20995C20
 12. 4202-()-()
 13. 4267-5
 14. 2869
 15. 4674
 16. 4675
 17. 4544
 - 17.1 3910
 18. 4674
 19. 4295-1
 - 19.1 4256
 - 19.2 4298
 - 19.3 4300-1
 - 19.3.1 4301-4
 - 19.3.2 4287-1
 - 19.4 4297-3
 - 19.5 4296
 20. 4265-3
 21. 2021
 22. 4280
 23. 4296-4
 24. 4537-B-3P

- LEGEND**
- FUEL CONTAINER PRESSURE SWITCH (FREBANK CO. 4188-1) (A)(B)(C)(D)(E)
- SHIELD ASSEMBLY (F)
- RIVET (4 PLACES) (F)
- SHIELD
- SPACER (2 PLACES)
- COVER
- SCREW (4 PLACES) (G)
- LOCKWIRE (H)
- SEALING RING (J)(K)
- SPACER (4 PLACES)
- LOCATING RING
- SCREW (L)(M)
- DIAPHRAGM PLATE ASSEMBLY
- DIAPHRAGM PLATE
- L. P. DIAPHRAGM (N)
- CENTERING RING
- INSULATION SLEEVE (3 PLACES)
- ELECTRICAL ASSEMBLY
- SWITCH BRACKET
- LOCK PLUG (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (O)
- SUBMINIATURE SWITCH (MADE FROM HAYDON SWITCH CORP. SWITCH NO. 53820-2) (D)
- MACHINE SCREW (WITH KEL-F INSERT) (MADE FROM LONG-KOL CORP. LL500A2-7) (2 PLACES) (D)(P)(Q)
- LOCKWIRE (H)
- ELECTRICAL WIRE (HIGH TEMPERATURE) (MIL-W-5086) (3 PLACES) (R)
- ADJUSTMENT RING (S)
- LOCK PLUG (2 PLACES) (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D)
- BELLEVILLE SPACER RING (INNER) (4 PLACES)
- BELLEVILLE SPACER RING (OUTER) (3 PLACES)
- BELLEVILLE SPRING ASSEMBLY
- BELLEVILLE SPRING (4 PLACES) (T)(U)
- BELLEVILLE SPACER RING (INNER) (D)
- BODY ASSEMBLY
- CAPILLARY TUBE (V)
- MACHINED BODY
- SHAFT DIAPHRAGM ASSEMBLY
- ACTUATION SHAFT
- L. P. DIAPHRAGM
- COMPENSATION RING (X)(Y)(Z)
- END FITTING (X)(Y)(Z)
- STOP SCREW (P)
- LOCK PLUG (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D)
- SPRING
- NAMEPLATE
- SOLDER MOUNT RECEPTACLE (BENDIX AVIATION CORP. - PYGMY TYPE) (D)

DRAWN BY:	<i>J. R. Ragh</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30184	REVISION DATE OF THIS PAGE
PLANNER:	<i>F. J. Phillips</i>		EO's	
WRITER:	<i>G. J. Hoffmann</i>			
APPROVED BY:	<i>J. R. Ragh</i>		ART CONTROL NO. M-ME-E-906	



- NOTE:
1. SEE PAGE 4 FOR THE 20M30184 FUEL CONTAINER PRESSURE SWITCH EFFECTIVITY.
 2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ARE 3.1 BY 3.1 BY 2.3 INCHES.
 3. THE APPROXIMATE UNIT WEIGHT IS ONE POUND.

LOCATED UNDER SWITCH
REMOVE MAIN FOR CLARITY

WIRING DIAGRAM

(YELLOW) PIN "C" M.O.
(RED) PIN "B" COM
(GREEN) PIN "A" R.E.

1. High and low temperature nonvibration deactuation pressure setting:
0.5 to 2.0 p.s.i.d. of the actual actuation pressure.
- m. Vibration actuation pressure: Within +0 and -0.5 p.s.i. of the actual nonvibration actuation setting.
- n. Vibration deactuation pressure: Within +0.5 and -0 p.s.i. of the actual nonvibration deactuation setting.
- o. Vibration conditions differential pressure between actuating and deactuation pressures: 0.3 p.s.i. minimum.
- p. Vibration switch contact chatter: No chatter allowed when vibrated and pressurized to 0.75 p.s.i. below the actual nonvibration actuation setting.

1.2 Electrical Performance Requirements. The electrical performance requirements of the pressure switch are as follows:

- a. Operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal.
- b. Subminiature switch: Single pole, double throw, with a 3 a. resistive load rating of 28 v.d.c.

CAUTION: The maximum resistive load applied to the switch assembly during fabrication or testing must not be greater than 0.5 a.

- c. Circuit resistance: 0.5 ohm maximum between pins "A" and "B" (circuit closed) and pins "B" and "C" (circuit closed).
- d. Insulation resistance: 50 megohm minimum with 500 v.d.c. applied between each connector pin and the switch body or between connector pins when the switch circuits are fully open.
- e. The wiring diagram is shown on page 3.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The pressure switch is designed to withstand without actuation, damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes while increasing pressurization from zero to 0.75 p.s.i. below the actual actuation pressure of the switch:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The pressure switch is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions while increasing pressurization from zero to 0.75 p.s.i. below the actual actuation pressure:

1.4 (con.)

20 to 55 c.p.s. at 3 g's,
55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the pressure switch are outlined in Performance Specification 10M01145 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 MIL-Q-9858
 MIL-W-5086
NASA - MSFC-SPEC-164
 MSFC-PROC-158

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-643
 MS33540
 MS33586

3.3 Drawings:

Ordnance Corps - 10419909
 10509300
 10509302
 10509311
MSFC - 10M01145

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	
SA-6	
SA-7	
SA-8	
SA-9	
SA-10	
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

SUMMARY SHEET

Nomenclature Switch, Control Pressure (LOX)

Drawing Numbers: 10414340,
20M30185

Vendor: Frebank Co.

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 2,000 cy.

Failure Rate: $14,948 \times 10^{-6}/\text{cy.}$

MCBF (in cycles): 66.9

Total Number of Components
this Data Represents: 29

Total Cycles of Operation:
1,272

Total Number of
Failures Reported: 19

Vehicle Equipment: X
Ground Equipment:

December 1965

II.17.3
Page 1 of 15

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
<u>1</u>	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>17</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-9 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Switch, Control Pressure (LOX)	
Drawing Numbers: 10414340	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $25,773 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 38.8
Number of Components this Data Represents: 15	Total Cycles of Operation: 466*
Number of Failures Reported: 12	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>six shocks, 6 ms 35 g</u>	
High Temperature: <u>165°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: <u>None allowed</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>110-2,000 cps at 20 g</u>	

December 1965

* Minimum operating time; serial no. 117
had no data on running cycle logs.

II.17.3

Page 3 of 15

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>11</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: Report No. IN-P&VE-E-62-5, January 21, 1962, MSFC			

Additional information concerning the component:

Twelve failures were reported on Inspection Reports.

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DATA SHEET	
Nomenclature: Switch, Control Pressure (LOX)	
Drawing Numbers: 20M30185	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 8,688 $\times 10^{-6}$ /cy.	MCBF (in cycles): 115.1
Number of Components this Data Represents: 14	Total Cycles of Operation: 806
Number of Failures Reported: 7	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: (Same as on page 3, II.17.3).	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

II.17.3
Page 7 of 15

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>6</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30185 component:

Seven failures were reported on Inspection Reports.

(Intentionally Left Blank)

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 5 December 1962
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30185 LOX PRESSURIZING AND RELIEF SWITCH		PROCEDURE MP1-2000
APPROVED <i>P. G. G. G.</i>		PAGE 1 of 4

1. DESCRIPTION.

The LOX pressurizing and relief switch 20M30185 is a pneumatically operated pressure switch that indicates electrically at a predetermined pressure. The switch is a component of both the preflight and in-flight LOX tank pressurization system. If the pressure in the LOX container exceeds approximately 60 p.s.i.a. a signal from the switch to the 20M30172 valve and orifice assembly will open the 20M30460 (formerly 20M30121) LOX relief valve No. 2 and reduce the pressure in the container. The switch is located on the 10M10214 LOX pressure switch assembly in the forward skirt of container LC as shown in the installation view. The various functional characteristics of the switch are as follows:

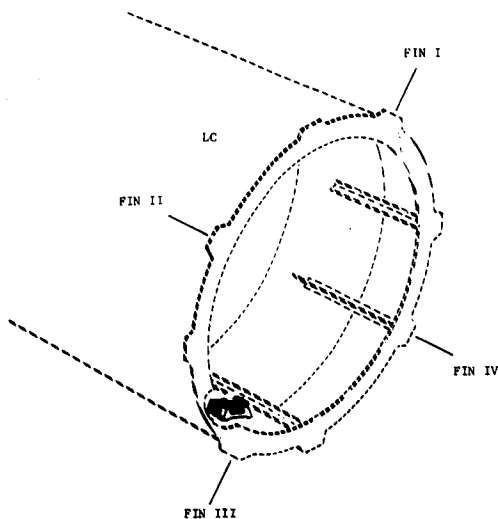
1.1 Operating Characteristics. The operating characteristics of the switch are as follows:

- a. Indicating pressure setting range: Factory adjustable within 10 to 100 p.s.i.a.
- b. Operating media: Gaseous oxygen, gaseous nitrogen, or air.
- c. Operating temperature range: -65° to +165° F.
- d. Operating pressure: 100 p.s.i.a. minimum internal pneumatic pressure.
- e. Proof pressure: 200 p.s.i.a. minimum internal pneumatic pressure.
- f. Burst pressure (without failure): 500 p.s.i.a. minimum internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- g. Vacuum withstanding capability: 0 to +0.5 p.s.i.a.
- h. Room temperature nonvibration actuation pressure (increasing) setting: 59.5 ± 0.5 p.s.i.a. on the second and succeeding cycles of operation at room temperature (77° \pm 18° F.) (possess continuity between electrical connector pins "B" and "C"). The actual pressure of the first actuation must be within ± 0.6 p.s.i. of the actual pressure obtained on the second and succeeding cycles of operation.
- i. Room temperature deactuation pressure (decreasing) setting: 1.0 minimum to 3.5 p.s.i.d. maximum of the actual actuation pressure (possess continuity between electrical connector pins "A" and "B").
- j. High and low temperature nonvibration actuation pressure setting: Within ± 1.5 p.s.i. of the actual actuation pressure obtained in step h. on the second and succeeding cycles of operation at high or low temperatures (-65° to +59° F. or +95° to +165° F.). The actual pressure of the first actuation must be within ± 0.6 p.s.i. of the pressure obtained on the second and succeeding cycles of operation except as follows: When the switch is tested at -65° F. after a direct temperature change from 77° \pm 18° F. the actual pressure of the first actuation must be within 1.4 p.s.i. of the actual pressure obtained on the second and succeeding cycles of operation.

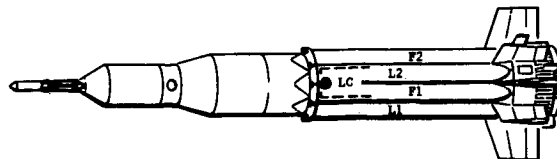
REVISION DATA

(Continued on page 4)

20M30185



INSTALLATION VIEW - LOOKING AFT



GENERAL LOCATION

NOTES (CON.)

- (A) TORQUE 960 TO 1,080 INCH-POUNDS.
- (S) SOLDER TO BODY (11.2) THROUGH HOLES IN 11.2 IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SN60.

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
- (B) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (C) STAMP THE CURE DATE OF OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH MSFC-STD-105.
- (D) OR APPROVED EQUIVALENT.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) TORQUE 60 TO 85 INCH-POUNDS.
- (G) SOLDER TO BODY (11.2) IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SN60.
- (H) KEL-F INSERT INSTALLED BY LONG-LOK CORP.
- (J) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (K) SOLDER THE ELECTRICAL WIRES 4402-1-14 (RED), 4402-2-14 (YELLOW), AND 4402-3-14 (GREEN) TO THE SUBMINIATURE SWITCH IN ACCORDANCE WITH THE WIRING DIAGRAM.
- (L) TORQUE 600 TO 900 INCH-POUNDS.
- (M) A COMBINATION OF APPROXIMATELY SEVEN SPRINGS (3910-2) GIVES THE REQUIRED INCREASING SNAP LOAD OF 132 ± 4 POUNDS AND DECREASING SNAP LOAD OF 60 ± 2 POUNDS.
- (N) PART OF THE SEVEN INNER RINGS REQUIRED IN CALLOUT 7, READING FROM RIGHT TO LEFT, CALLOUTS 10, 9, 1, 8, AND 7 ARE SHOWN IN SEQUENCE OF INSTALLATION, AS INNER RING, SPRING, OUTER RING, INNER RING, AND SO ON UNTIL REQUIRED NUMBER OF EACH IS INSTALLED.
- (P) SOLDER TO BODY (11.2) AND FREE END IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SN60.
- (Q) SOLDER TO END FITTING (11.5) IN ACCORDANCE WITH MSFC-PROC-158 USING SOLDER CONFORMING TO QQ-S-571C/SN60.

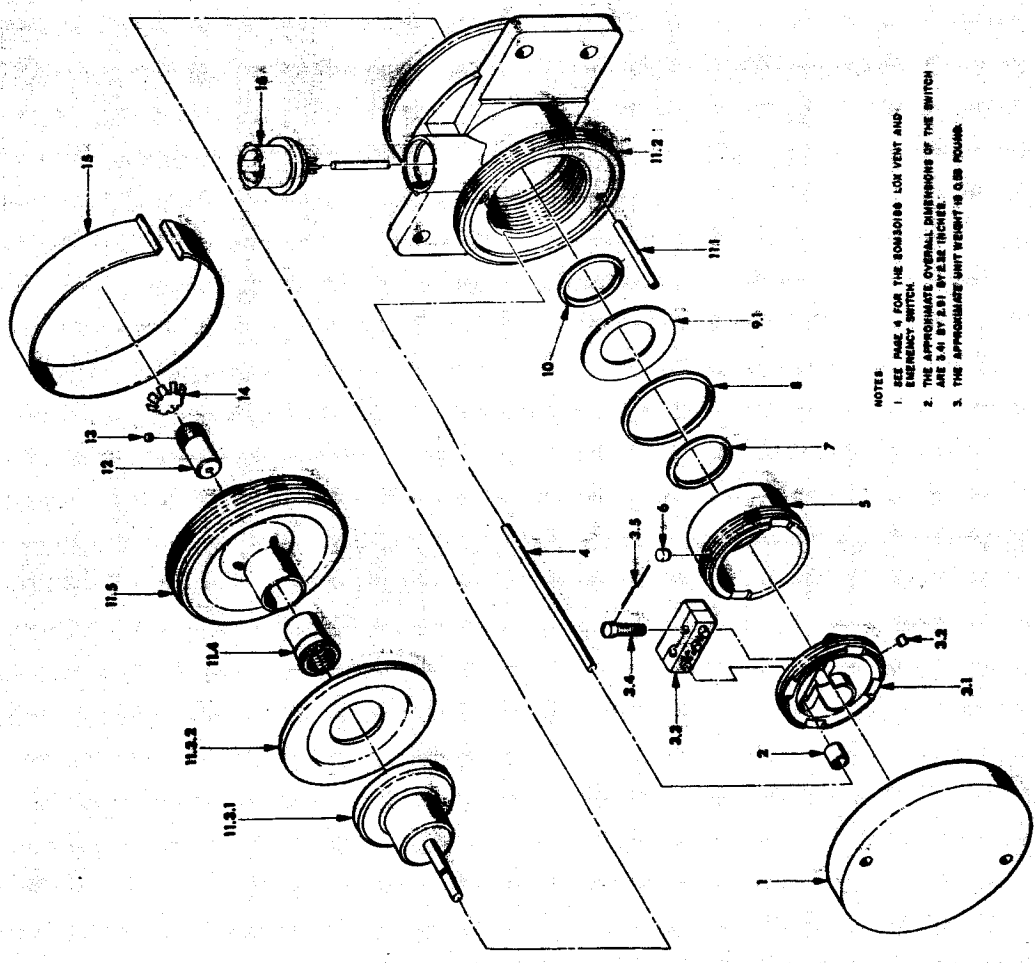
20M30185

- 1. 4303
- 2. 3885-3
- 3. 4289-1
- 3.1 4290-2
- 3.2 2869
- 3.3 4258-4
- 3.4 4259
- 3.5 MS20995C20
- 4. 4402-()-()
- 5. 4267-11
- 6. 2869
- 7. 4674
- 8. 4675
- 9. 4609
- 9.1 3910-2
- 10. 4674
- 11. 4295-2
- 11.1 4256
- 11.2 4298
- 11.3 4300-3
- 11.3.1 4291-1
- 11.3.2 4287-1
- 11.4 4297-3
- 11.5 4296
- 12. 4265-3
- 13. 2021
- 14. 4280
- 15. 4494-2
- 16. 4537-8-3P

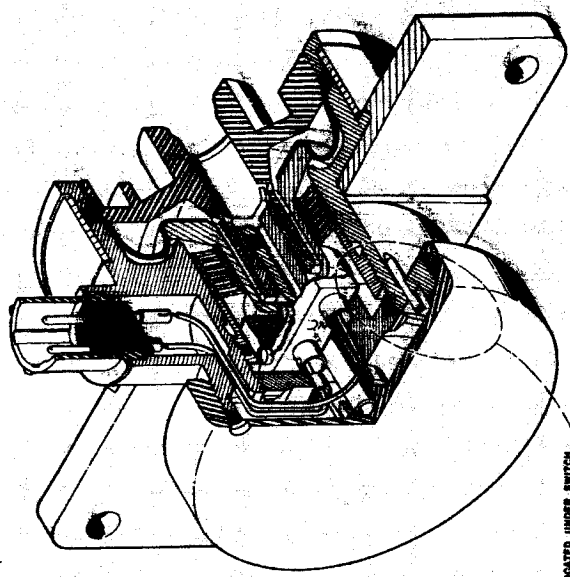
LEGEND

- LOX PRESSURIZING AND RELIEF SWITCH (EO-2) (PREPARK CO. 4184-1) (A) (B) (C)
- (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q)
- COVER (P)
- INSULATION SLEEVE (3 PLACES)
- ELECTRICAL ASSEMBLY
- SWITCH BRACKET
- LOCK PLUG (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D)
- SUBMINIATURE SWITCH
- MACHINE SCREW (WITH KEL-F INSERT) (MAKE FROM LONG-LOK CORP. LL500A2-7) (2 PLACES) (D) (F) (H)
- LOCKWIRE (J)
- ELECTRICAL WIRE (HIGH TEMPERATURE) (MIL-W-5086) (3 PLACES) (K)
- ADJUSTMENT RING (L)
- LOCK PLUG (2 PLACES) (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D)
- BELLEVILLE SPACER RING (INNER) (7 PLACES)
- BELLEVILLE SPACER RING (OUTER) (6 PLACES)
- BELLEVILLE STACK ASSEMBLY
- BELLEVILLE SPRING (7 PLACES) (M) (N)
- BELLEVILLE SPACER RING (INNER)
- BODY ASSEMBLY (P)
- CAPILLARY TUBE
- MACHINED BODY
- SHAFT DIAPHRAGM ASSEMBLY
- ACTUATION SHAFT
- L. P. DIAPHRAGM
- COMPENSATION RING
- END FITTING (R) (S) (O)
- STOP SCREW (F) (S) (O)
- LOCK PLUG (EXTRUDED NYLON MATERIAL MAY BE PURCHASED FROM E. I. DUPONT DE NEMOURS & CO., WILMINGTON, DEL.) (D)
- SPRING
- NAMEPLATE
- SOLDER MOUNTED RECEPTACLE (BENDIX AVIATION CORP. - PYGMY TYPE) (D)

DRAWN BY:	<i>Lawrence J. Cress III</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30185	REVISION DATE OF THIS PAGE
PLANNER:	<i>J. V. Phillips</i>		EO's -2	
WRITER:	<i>G. D. Schump</i>			
APPROVED BY:	<i>M. Schimpf</i>		ART CONTROL NO. M-ME-E-904	



- NOTES
1. SEE PAGE 4 FOR THE SENSOR LON VENT AND EMERGENCY SWITCH.
 2. THE APPROXIMATE OVERALL DIMENSIONS OF THE SWITCH ARE 3.41 BY 2.91 BY 2.12 INCHES.
 3. THE APPROXIMATE UNIT WEIGHT IS 0.18 POUNDS.



- k. High and low temperature nonvibration deactuating pressure setting: 1.0 to 3.5 p.s.i.d. of the actual actuation pressure.
- l. Vibration actuation pressure: Within +0 and -1.0 p.s.i. of the actual nonvibration actuation setting.
- m. Vibration deactuation pressure: Within +1.0 and -0 p.s.i. of the actual nonvibration deactuation setting.
- n. Vibration conditions differential pressure between actuating and deactuating pressures: 0.3 p.s.i. minimum.
- o. Vibration switch contact chatter: No chatter allowed when vibrated and pressurized to 2 p.s.i. below the actual nonvibration actuation setting.

1.2 Electrical Performance Requirements. The electrical performance requirements of the switch are as follows:

- a. Operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal.
- b. Subminiature switch: Single pole, double throw, with a 3 a. resistive load rating of 28 v.d.c.

CAUTION: Maximum resistive load applied to the switch during fabrication or testing must not be greater than 0.5 a.

- c. Circuit resistance: 0.5 ohm maximum between pins "A" and "B" (circuit closed) and pins "B" and "C" (circuit closed).
- d. Insulation resistance: 50 megohms minimum with 500 v.d.c. applied between each connector pin and the switch body or between connector pins when the switch circuits are fully open.
- e. The wiring diagram is shown on page 3.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes while increasing pressurization from zero to 2.0 p.s.i. below the actual actuation pressure of the switch:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions while increasing pressurization from zero to 2.0 p.s.i. below the actual actuation pressure:

1.4 Vibration Withstanding Capability. (con.)

20 to 55 c.p.s. at 3 g's,
 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the switch are outlined in Performance Specification 10M01144 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 MIL-Q-9858
 MIL-W-5086
 NASA - MSFC-SPEC-164
 MSFC-PROC-158

3.2 Standards:

Military - MIL-STD-130
 MIL-STD-643
 MS33540
 MS33586
 NASA - MSFC-STD-105

3.3 Drawings:

Ordnance Corps - 10509302
 MSFC - 10M01144

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	EO-2
SA-6	EO-2
SA-7	EO-2
SA-8	EO-2
SA-9	EO-2
SA-10	EO-2
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30185

REVISION DATE

SUMMARY SHEET	
Nomenclature Switch (Step Pressure, LOX)	
Drawing Numbers: 10414068, 20M30144	Vendor: Servomechanisms Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $11,628 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 14 Total Number of Failures Reported: 9	MCBF (in cycles): 86 Total Cycles of Operation: 774 Vehicle Equipment: X Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted:
<u>5</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Other: <u>1</u> <u>operates without</u> <u>pressure</u> <u> </u>
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-5 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Switch, Step Pressure (LOX)	
Drawing Numbers: 10414068	Vendor: Servomechanisms Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $22,523 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 44.4
Number of Components this Data Represents: 7	Total Cycles of Operation: 311
Number of Failures Reported: 7	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>6 shocks at 35 g, 6 milliseconds</u>	
High Temperature: <u>165°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: <u>Not specified</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20-55 cps at 5 g, 55-110 cps at 0.03 in. D.A.d., 110-2,000 cps at 20 g</u>	

December 1965

II.17.4
Page 3 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>4</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC, IN-P&VE-E-62-5, February 21, 1962			

Additional information concerning the 10414068 component:

Six failures reported on Inspection Reports and one failure on an Unsatisfactory Condition Report.

(Intentionally Left Blank)

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 28 April 1962
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414068 LOX STEP PRESSURE SWITCH ASSEMBLY		PROCEDURE EP-140
APPROVED <i>[Signature]</i>		PAGE 1 of 4

1. DESCRIPTION.

The LOX step pressure switch assembly 10414068 is a pressure operated pressure switch designed to have an output indication at a preset differential pressure. The pressure switch assembly is used to energize an indicator showing that the LOX has reached a specific predetermined filling level in the LOX container. The pressure switch assembly is used in the replenishing sequence of the LOX system. The pressure switch assembly is located in the aft skirt of container F2 as shown in the installation view. The various functional characteristics of the pressure switch assembly are as follows:

1.1 Operating Characteristics. The operating characteristics of the pressure switch assembly are as follows:

- a. Operating media: Air, gaseous nitrogen, and gaseous oxygen.
- b. Nominal operating temperature: -65° to +165° F.
- c. Proof pressure: Nominal differential - minimum at port "A" is 30 p.s.i. greater than at port "B". Reverse differential - minimum at port "B" is 20 p.s.i. greater than at port "A".
- d. Burst pressure (without bursting): 160 p.s.i.g. minimum applied to both ports simultaneously. (CAUTION: Use only for destructive acceptance testing.)
- e. Line operating pressure: 65 p.s.i.g. applied to both ports simultaneously.
- f. Increasing indication differential pressure: 22.5 p.s.i.g. indicated.
- g. Decreasing indication differential pressures: Within 0.3 p.s.i. of pressure specified in step f. at supply voltages of 26 to 30 v.d.c. - 0.45 p.s.i. with supply voltages of 22 to 26 v.d.c. or 30 to 32 v.d.c.
- h. Switch accuracy: +0.5 percent of nominal pressure setting at supply voltages from 26 to 30 v.d.c. - +1.0 percent at supply voltages from 22 to 26 v.d.c. or 30 to 32 v.d.c.

1.2 Electrical Performance Characteristics. The pressure switch assembly is capable of performing electrically as follows:

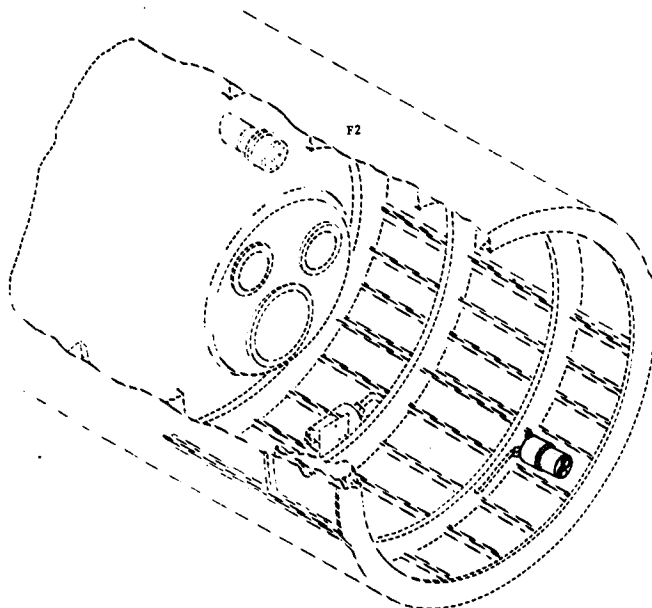
- a. Indicating element: Solid state switch.
- b. Indicating element operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal and a maximum of 400 millivolt ripple.
- c. Heater operating voltage: 100 to 120 volt, 60 cycle, single phase system with 110 v.a.c. nominal.
- d. Heater control: Snap action type thermostat.
- e. Heater power: 80 watt maximum.
- f. Insulation resistance: 50 megohms minimum between each electrical connector pin and the switch body with 500 v.d.c. applied.
- g. Switch indication: With inlet differential pressure greater than the pressure setting - output is 0 v.d.c. +0.5 v.d.c. or -0 v.d.c. at 200 +20 ohms resistive load. With inlet differential pressure less than the pressure setting - voltage drop is 2 v.d.c. maximum at 200 +20 ohms resistive load.

(Continued on page 4)

REVISION DATE	10414068
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GENERAL LOCATION



INSTALLATION VIEW - LOOKING FORWARD

==NOTES==

- (A) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (B) STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (C) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (D) OR APPROVED EQUIVALENT.
- (E) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (F) PERFORM RECEIVING AND INSTALLATION INSPECTION IN ACCORDANCE WITH PROCEDURE 20M30397

==LEGEND==

10414068 LOX STEP PRESSURE SWITCH ASSEMBLY
 ("A" REV.) (SERVOMECHANISMS, INC.
 816105, TYPE TR 2124) (A) (B) (C)
 (D) (E) (F)

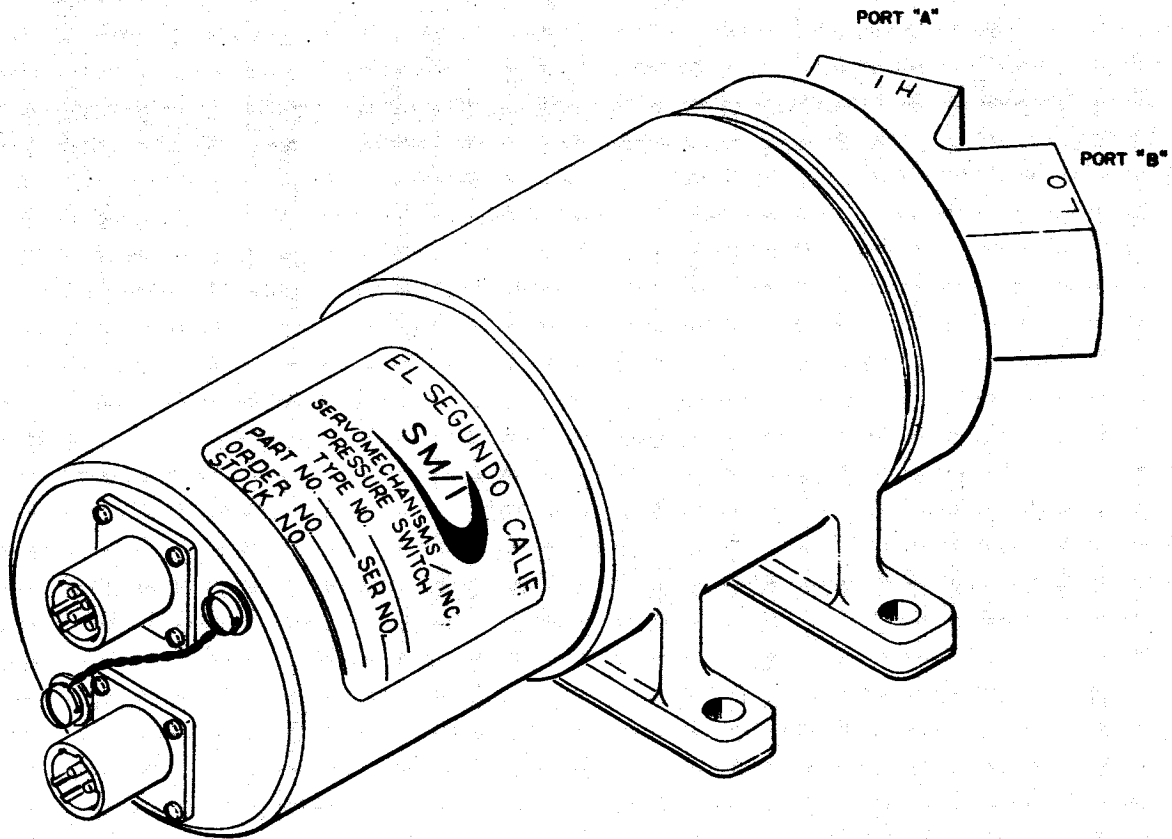
DRAWN BY:	<i>B. Dennis</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414068	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. L. Bennett</i>	A	EO'S	
WRITER:	<i>W. W. Franklin</i>		-3	
APPROVED BY:	<i>M. Hightower</i>		ART CONTROL NO. M-ME-EP140-750	

MSFC - Form 1151-1 (June 1961)

MANUFACTURING PLAN

PROCEDURE EP-140

PAGE 3 of 4



NOTES:

1. SEE PAGE 4 FOR THE 10414068 LOX STEP PRESSURE SWITCH ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ASSEMBLY ARE 7.00 BY 3.00 BY 2.50 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 2.80 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

REVISION DATE

M-ME-EP140-750

10414068

MSFC - Form 1151-2 (June 1961)

- 1.3 Life Cycle. The pressure switch assembly is capable of operating a minimum of 5,000 cycles without damage or impairment of performance.

CAUTION: Paragraphs 1.4, 1.5, and 1.6 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The pressure switch assembly is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

- 1.5 Nonoperating Vibration Withstanding Capability. The pressure switch assembly is designed to withstand without operating, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 3.0 g's,
55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
100 to 2,000 c.p.s. at 10 g's.

- 1.6 Operating Vibration Withstanding Capability. The pressure switch assembly is designed to withstand while operating, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 2,000 c.p.s. at 2.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the pressure switch assembly are outlined in Performance Specification 10419949, MSFC Receiving and Installation Inspection Procedure 20M30397, and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106
Military - MIL-W-5086
MIL-E-5272
MIL-Q-9858
MIL-O-25508

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33586
Army Ballistic Missile Agency -
ABMA-STD-428

3.3 Drawings:

Ordnance Corps - 10419909 10509300 10509305 20M30397
10419949 10509302 10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"A" Rev. and EO-3
SA-1	"A" Rev. and EO-3
SA-2	"A" Rev. and EO-3
SA-3	"A" Rev. and EO-3
SA-4	"A" Rev. and EO-3
SPARES	Before installing modify to latest configuration

10414068

REVISION DATE

DATA SHEET	
Nomenclature: Switch, Step Pressure (LOX)	
Drawing Numbers: 20M30144	Vendor: Servomechanisms Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 4,319 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 7 Number of Failures Reported: 2	MCBF (in cycles): 231.5 Total Cycles of Operation: 463 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: (Same as on page 3, II.17.4)	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: <u>1</u> <u>operates without</u> <u>pressure</u>
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 15 April 1963
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30144 LOX DIFFERENTIAL STEP PRESSURE SWITCH ASSEMBLY		PROCEDURE MPI-2000
APPROVED <i>P. Kelly</i>		PAGE 1 of 4

1. DESCRIPTION.

The LOX differential step pressure switch assembly 20M30144 is a component of the LOX replenishing system. The switch assembly is used in the replenishing sequence of the LOX system for giving an output indication at a preset differential pressure. A solid state switch is used as the indicating element for the switch assembly. Also the switch incorporates an integral thermostat and heater. Adjustment of the switch assembly output indication differential pressure is accomplished by exchanging calibrated resistors. The switch assembly is located in the aft skirt of container F3 as shown in the installation view. The various functional characteristics of the pressure switch assembly are as follows:

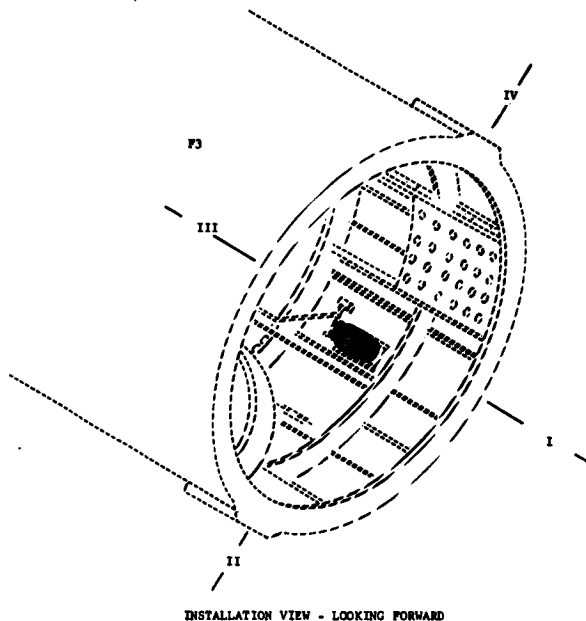
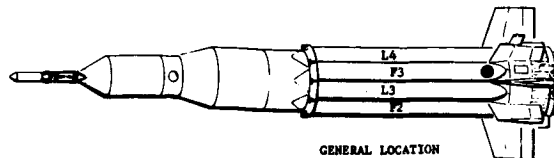
1.1 Operating Characteristics. The operating characteristics of the switch assembly are as follows:

- a. Operating media: Air, gaseous nitrogen, and gaseous oxygen.
- b. Nominal operating temperature: -65° to +165° F.
- c. Proof pressures: Without leakage between ports or external leakage. Nominal differential - minimum at port "A" is 30 p.s.i. greater than at port "B." Reverse differential - minimum at port "B" is 20 p.s.i. greater than at port "A."
- d. Burst pressure (without bursting): 160 p.s.i.g. minimum applied to both ports simultaneously. (CAUTION: Use only for destructive acceptance testing.)
- e. Line operating pressure: 65 p.s.i.g. applied to both ports simultaneously.
- f. Increasing indication differential pressure setting: 26.02 p.s.i.g. (obtained by exchanging calibrated resistors).
- g. Decreasing indication differential pressure setting: Within 0.3 p.s.i. of pressure specified in step f. at supply voltages of 26 to 30 v.d.c.; 0.45 p.s.i. with supply voltages of 22 to 26 v.d.c. or 30 to 32 v.d.c.
- h. Switch accuracy: $\pm 0.5\%$ of nominal pressure setting at supply voltages from 26 to 30 v.d.c.; $\pm 1.0\%$ at supply voltages from 22 to 26 v.d.c. or 30 to 32 v.d.c.

1.2 Electrical Performance Characteristics. The switch assembly is capable of performing electrically as follows:

- a. Indicating element: Solid state switch.
- b. Indicating element operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal and a maximum of 400 millivolt ripple.
- c. Heater operating voltage: 100 to 120 volt, 60 cycle, single phase system with 110 v.a.c. nominal.
- d. Heater control: Snap action type thermostat.
- e. Heater power: 80 watts maximum.
- f. Insulation resistance: 50 megohms minimum between each electrical connector pin and the switch body with 500 v.d.c. applied.
- g. Switch indication: With inlet differential pressure greater than the pressure setting - output is 0 v.d.c. +0.5 v.d.c. or -0 v.d.c. at 200 ± 20 ohms resistive load. With inlet differential

REVISION DATE 17 May 1963	(Continued on Page 4)	20M30144
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== NOTES ==

- Ⓐ IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- Ⓑ STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH NSFC-STD-103.
- Ⓒ CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- Ⓓ OR APPROVED EQUIVALENT.
- Ⓔ CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH NSFC-SPEC-164.
- Ⓕ PERFORM RECEIVING AND INSTALLATION INSPECTION IN ACCORDANCE WITH PROCEDURE 20M30333 (EO-1).
- Ⓖ ALL MATERIALS OTHER THAN SEALANTS CONTACTING GASEOUS OXYGEN MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH NSFC-SPEC-106.

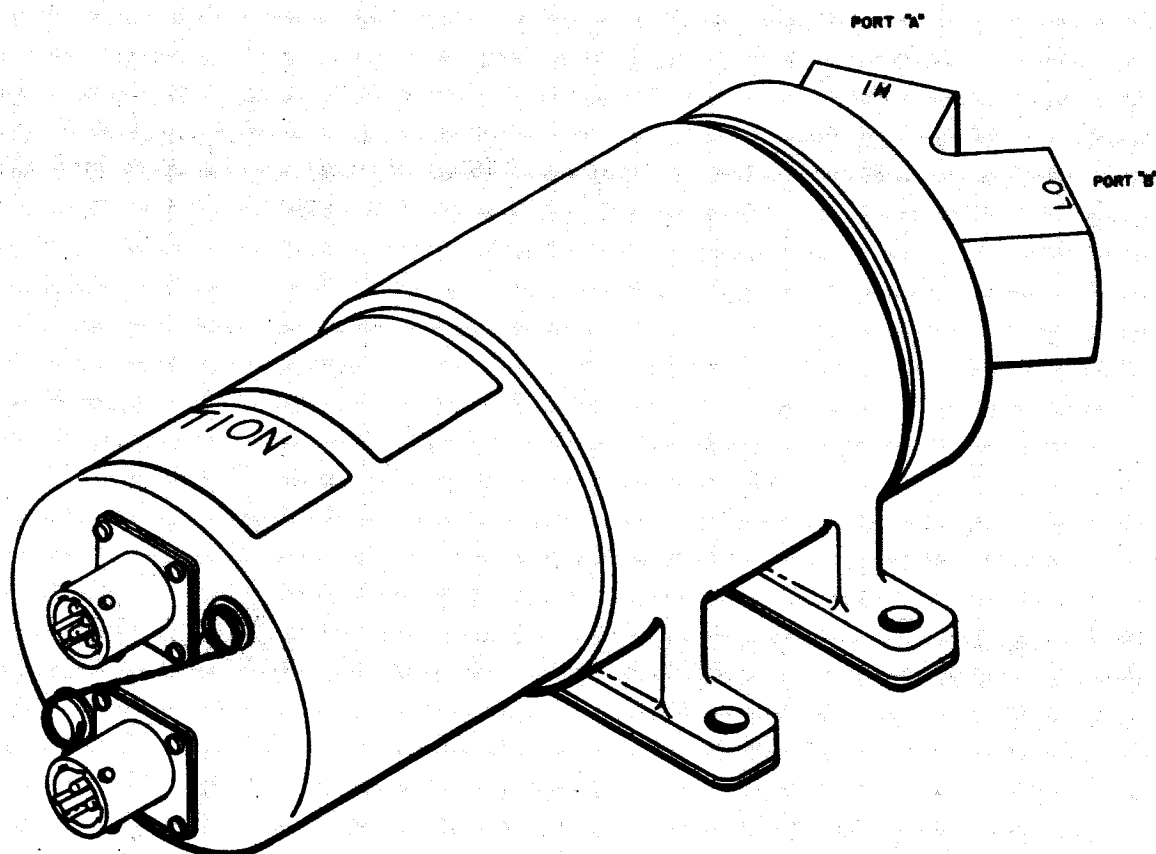
== LEGEND ==

20M30144	LOX DIFFERENTIAL STEP PRESSURE SWITCH ASSEMBLY ("A" REV. & EO-3) (SERVO-MECHANISMS, INC., 200 AVIATION BLVD., EL SEGUNDO, CALIF., 916105, TYPE TR 2124) Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ Ⓖ
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DRAWN BY:	<i>Bobby Davis</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	20M30144	REVISION DATE OF THIS PAGE
PLANNER:	<i>F. V. Phillips</i>	A	EO's	-3	17 May 1963
WRITER:	<i>A. E. Bohren</i>		ART CONTROL NO.	M-ME-E-1089-A	
APPROVED BY:	<i>M. J. G. Smith</i>				

MSFC - Form 1151-1 (June 1964)

MANUFACTURING PLAN

PROCEDURE
MPI-2000PAGE
3 of 4

NOTES:

1. SEE PAGE 4 FOR THE 20M30144 LOX DIFFERENTIAL STEP PRESSURE SWITCH ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ASSEMBLY ARE 2.50 BY 3.00 BY 7.00 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 2.58 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

SWITCH & HEATER RECEPTACLE CONNECTOR PIN FUNCTIONS

RECEPTACLE	PIN NO.	PIN FUNCTION
PT02-E-8-4P (SWITCH CONNECTOR)	A	28V.D.C. - NEG., INPUT & OUTPUT
	B	28V.D.C. - POS., INPUT
	C	28V.D.C. - POS., SWITCH OUTPUT
	D	BLANK
PT02-E-8-2P (HEATER CONNECTOR)	A	115 V.A.C. - HIGH
	B	115 V.A.C. - LOW

REVISION DATE

M-ME-E-1089

20M30144

1.2 (con.)

pressure less than the pressure setting - voltage drop is 2 v.d.c. maximum at 200 ± 20 ohms resistive load.

1.3 Life Cycle. The switch assembly is capable of operating a minimum of 5,000 cycles without damage or impairment of performance.

CAUTION: Paragraphs 1.4, 1.5, and 1.6 constitute destructive test items that are performed only at the option of the procuring activity.

1.4 Shock Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes with both ports pneumatically pressurized to 65 p.s.i.g.

10-milliseconds duration - triangular wave, or 8-milliseconds duration - sine wave, or 6-milliseconds duration - square wave.

1.5 Nonoperating Vibration Withstanding Capability. The switch assembly is designed to withstand without operating, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes with both ports pneumatically pressurized to 65 p.s.i.g. under the following conditions:

20 to 55 c.p.s. at 3.0 g's, 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and 100 to 2,000 c.p.s. at 10.0 g's.

1.6 Operating Vibration Withstanding Capability. The switch assembly is designed to withstand while operating, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes while connected electrically and pneumatically under the following conditions:

20 to 2,000 c.p.s. at 2.0 g's.

2. TEST AND DELIVERY REQUIREMENTS

The destructive and nondestructive acceptance tests and the preparation for delivery of the switch assembly are outlined in Performance Specification 10M01386, MSFC Receiving and Installation Inspection Procedure 20M30333, and Packaging and Packing Specification 10509302.

3. REFERENCES:

3.1 Specifications:

NASA - MSFC-SPEC-106, & -164
Military - MIL-W-16878

3.2 Standards:

Military - MIL-STD-130, & MS33586
NASA - MSFC-STD-105

3.3 Drawings:

Ordnance Corps - 10509302; MSFC - 10419909, 10M01386, & 20M30333

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	"A" Rev. and EO-3
SA-6	"A" Rev. and EO-3
SA-7	"A" Rev. and EO-3
SA-8	"A" Rev.
SA-9	"A" Rev.
SA-10	"A" Rev.
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30144

REVISION DATE

17 May 1963

SUMMARY SHEET	
Nomenclature Switch Pressure	
Drawing Numbers: 10414042, 20M30135	Vendor: Southwestern Inc., MSFC
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $4,659 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 25 Total Number of Failures Reported: 6	MCBF (in cycles): 214.6 Total Cycles of Operation: 1,288 Vehicle Equipment: X Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish	<u>1</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>4</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2, 3, 4, 5, 6, 7, and 9 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Switch Pressure	
Drawing Numbers: 10414042	Vendor: Southwestern Inc., MSFC
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $7,112 \times 10^{-6}/\text{cy.}$	MBHF (in cycles): 140.6
Number of Components this Data Represents: 8	Total Cycles of Operation: 422
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>6 shocks at 65 g, 6 milliseconds square wave</u>	
High Temperature: <u>165°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>55-140 cps at 0.03 in. D.A.d., 140-2,000 cps at 30 g, 20-55 cps at 5 g</u>	

December 1965

II.17.5
Page 3 of 18

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>1</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>2</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2, 3, and 4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report # IN-P&VE-E-62-5, January 21, 1962			

Additional information concerning the 10414042 component:

All three failures were reported on Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414042 750 P.S.I. PRESSURE SWITCH		28 June 1962 APPROVED <i>P. Boetz</i>
		PROCEDURE
		EP-140
		PAGE
		1 of 4

1. DESCRIPTION.

The 750 p.s.i. pressure switch 10414042 is a single-pole, double throw, pneumatically operated switch that indicates both increasing and decreasing pressures within the range specified below. The switch is a component of the control pressure system. The switch is used to sense the output pressure of the 750 p.s.i.g. regulator assembly 10414038 that reduces the GN₂ pressure from the control pressure system high pressure spheres assembly to approximately 750 p.s.i.g. The switch is located on the control pressure high pressure sphere assembly in the rear skirt of container F2 as shown in the installation view. The various functional characteristics of the switch are as follows:

1.1 Mechanical Performance Characteristics. The switch is capable of performing mechanically as follows:

- a. Operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- b. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure.
- c. Burst pressure (without failure): 1,875 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- d. Actuating pressure (increasing): 625 ± 25 p.s.i.g. to obtain electrical continuity between the connector pins "B" and "C".
- e. Deactuating pressure (decreasing): 50 p.s.i.d. maximum with respect to pressure of step d. above to obtain electrical continuity between connector pins "A" and "B".
- f. External leakage with 750 p.s.i.g. pneumatic pressure applied to the inlet port: None allowed.
- g. Operating temperature range: -40° to +165° F.
- h. Operating media: Gaseous nitrogen or air.

1.2 Electrical Performance Requirements. The electrical performance requirements of the switch are as follows:

- a. Rating: 2.5 a. resistive load at 28 v.d.c. (CAUTION: Do not apply more than 0.5 a. resistive load to the switch during fabrication or testing.)
- b. Operating voltage: 18 to 30 v.d.c.
- c. Closed circuit contact resistance between electrical connector pins "A" and "B" or "B" and "C": 0.5 ohm maximum. (NOTE: At no time shall both indicating circuits be open or closed at the same time.)
- d. Insulation resistance (500 v.d.c. test): 50 megohms minimum between each isolated electrical connector pin and the switch case.

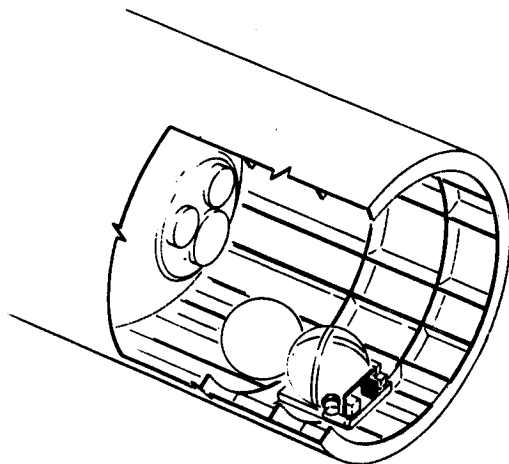
CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

(Continued on page 4)

REVISION DATE 26 OCT 1962	10414042
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GENERAL LOCATION



INSTALLATION VIEW - LOOKING FORWARD

NOTES

- A CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSPC-SPEC-164.
- B STAMP THE CURE DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH MSPC-STD-103.
- C IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- D OR APPROVED EQUIVALENT.
- E LOCKWIRE IN ACCORDANCE WITH MS33540.
- F TORQUE 17 TO 19 INCH-POUNDS.
- G LUBRICATE WITH KEL-F-10 POLYMER OIL OR APPROVED EQUIVALENT.
- H TORQUE TO 3 INCH-POUNDS.
- J APPLY LOCK-TITE-A COMPOUND TO THREADS.
- K TORQUE 40 TO 60 INCH-POUNDS.
- L HOLD PRESSURE ADJUSTMENT SCREW AND TORQUE 17 TO 19 INCH-POUNDS.
- M INSTALL WITH THE KEY IN THE POSITION SHOWN.
- N SOLDER TO ELECTRICAL CONNECTIONS IN ACCORDANCE WITH MSPC-PROC-158.

LEGEND

10414042	750 P.S.I. PRESSURE SWITCH ("B" REV.) (SOUTHWESTERN INDUSTRIES INC., P83100A)
1. MS20995C32	LOCKWIRE
2. #12-32-0.6094	SCREW
3. 3758	INLET FITTING
4. 3746-1	SILICONE DIAPHRAM
5. 3752	ACTUATOR RETAINER
6. #12-32-0.3594	ACTUATOR ASSEMBLY
7. 6457	SCREW
8. 6457	COVER
9. 6461	GASKET
10. 6304	BRACKET ASSEMBLY
10.1 SM-1913	CLINCHING FASTENER
10.2 6462	BRACKET
11. #3-56	SELF LOCKING NUT
12. 3822-3	PLATE
14. MS25085-1	SWITCH SHIM (FISHPAPER)
15. #6-32	ELECTRICAL SWITCH
16. 6495	SWITCH SHIM
17. #3-56-0.4844	SELF LOCKING NUT
18. #6-32-0.6719	SPACER
19. #6-32-0.2656	SPACER
20. 3728	SCREW
21. 3702	SCREW
22. AN526-1032-4	RETAINING RING
23. 3724	SPRING ASSEMBLY
23.1 3723	LEAF SPRING
23.2 6345	TRUSS HEAD SCREW
23.3 3709	SPRING FULCRUM
23.4 3723	SPRING DRUM
23.5 6345	TIP INSERT
24. 3709	SPRING WASHER
25. #12-32	SPRING PIVOT PIN
26. #12-32-1.25	LOCKNUT
27. #6-40-0.2344	PRESSURE ADJUSTMENT SCREW
28. MS20995C20	THREADED INSERT
29. MS3102N-148-7P	SCREW
30. SN1507-24	LOCKWIRE
31. 6464	RECEPTACLE
32. 6464	ELECTRICAL WIRING (MIL-W-16878B, TYPE E, 20 GAGE)
33. 6464	GASKET
34. 6464	CASE

DRAWN BY:

J. Bote

PLANNER:

John L. Bennett

WRITER:

C. Lockhart

APPROVED BY:

W. Hightower

ENGINEERING
DRAWING
RELEASE

B

REVISION TO:

10414042

EO'S

ART CONTROL NO.

M-MS-EP140-774-A

REVISION
DATE OF
THIS PAGE

26 Oct 1962

MANUFACTURING PLAN

PROCEDURE

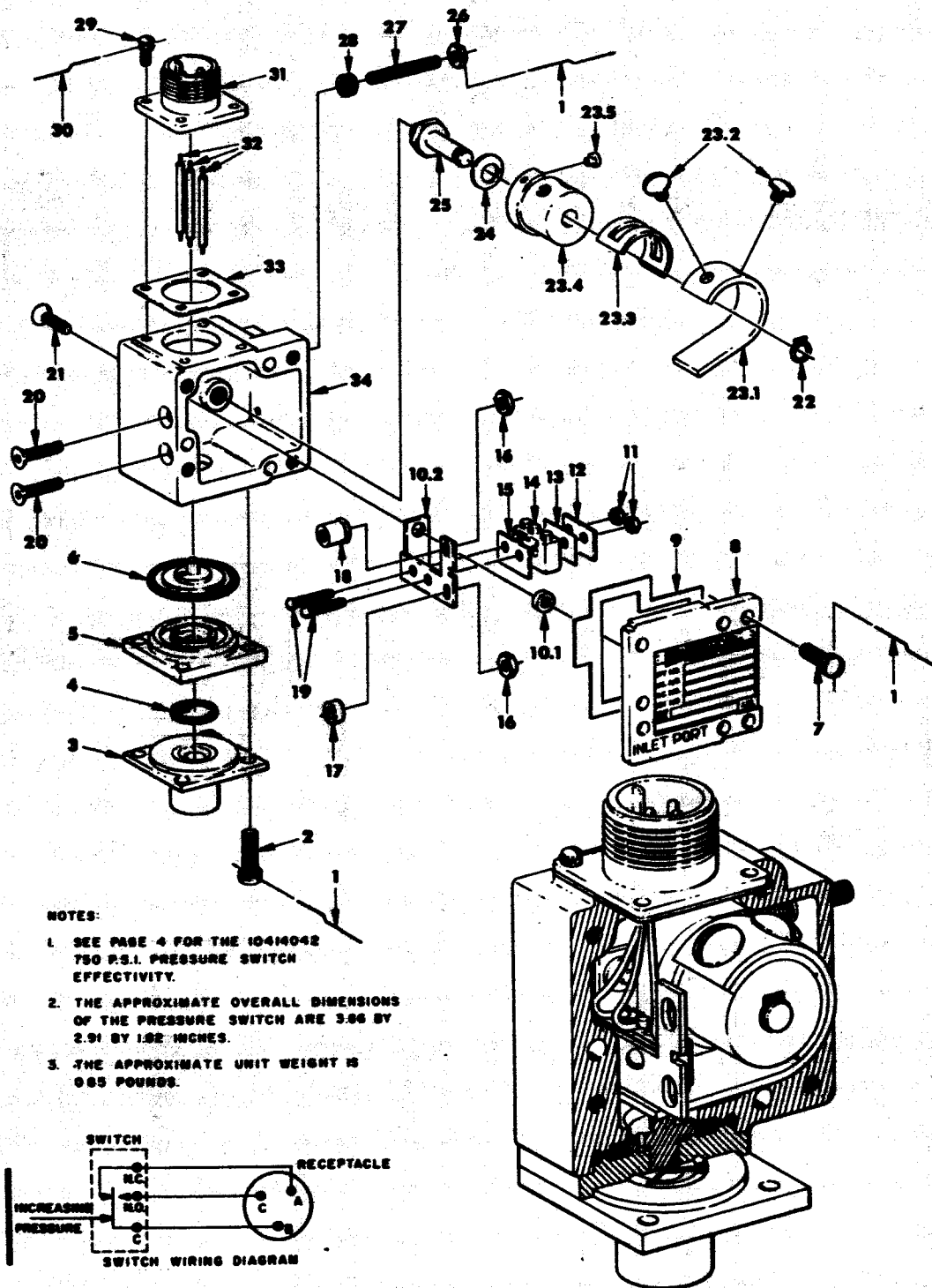
EP-140

PAGE

3

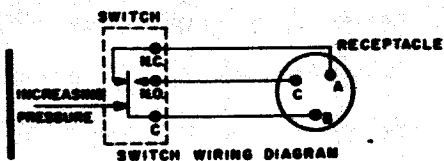
OF

4



NOTES:

1. SEE PAGE 4 FOR THE 10414042 750 P.S.I. PRESSURE SWITCH EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ARE 3.66 BY 2.91 BY 1.62 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 665 POUNDS.

REVISION DATE
26 OCT 1962

MSFC - Form 1151-2 (June 1961)

M-NE-E-774-A

10414042

1.3 Shock Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 65 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

- 20 to 55 c.p.s. at 5 g's,
- 55 to 95 c.p.s. at 0.03-inch double amplitude displacement, and
- 95 to 2,000 c.p.s. at 15 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the switch are outlined in Performance Specification 10419971 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858
NASA - MSFC-PROC-158
MSFC-SPEC-164

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile
Agency - ABMA-STD-18
NASA - MSFC-STD-105

3.3 Drawings:

Ordnance Corps - 10509302
10509303
MSFC - 10419971

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"B" Rev.
SA-1	"B" Rev.
SA-2	"B" Rev.
SA-3	"B" Rev.
SA-4	"B" Rev.
SPARES	

10414042

REVISION DATE 26 OCT 1962

DATA SHEET	
Nomenclature: Switch Pressure	
Drawing Numbers: 20M30135	Vendor: NASA/MSFC
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $3,472 \times 10^{-6}/\text{cy.}$	MCHF (in cycles): 288
Number of Components this Data Represents: 17	Total Cycles of Operation: 866
Number of Failures Reported: 3	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: (Same as on page 3, II.17.5)	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>1</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5, 6, 7, and 9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30135 component:

All three failures were reported on Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 18 January 1963
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 20M30135 750 P.S.I. PRESSURE SWITCH		PROCEDURE MP1-2000
APPROVED <i>F. Wechsung of Acty</i>		PAGE 1 of 4

1. DESCRIPTION.

The 750 p.s.i. pressure switch 20M30135 is a pneumatically operated switch that indicates both increasing and decreasing pressures within the range specified below. The switch is a component of the control pressure system. The switch is used to monitor the output pressure of the 750 p.s.i.g. regulator assembly 20M30134 that reduces the GN₂ pressure from the high pressure sphere assembly 20M00877 to approximately 750 p.s.i.g. The switch is located on the high pressure sphere assembly in the rear skirt of container F3 as shown in the installation view. The various functional characteristics of the switch are as follows:

1.1 Mechanical Performance Characteristics. The switch is capable of performing mechanically as follows:

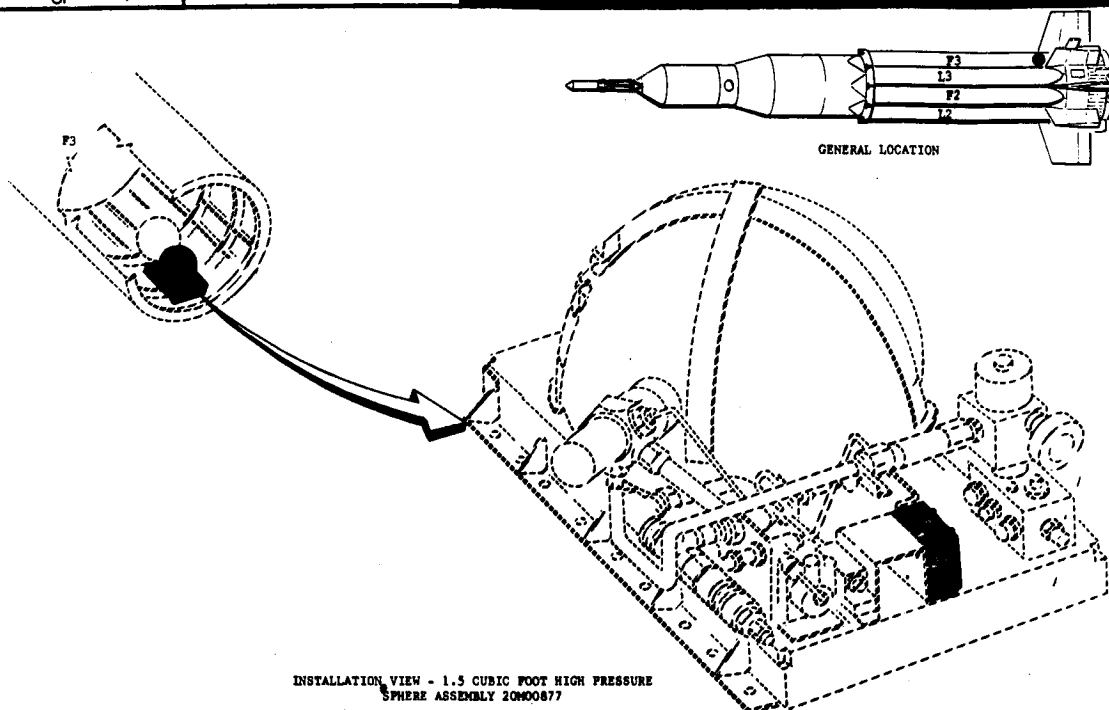
- a. Operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- b. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure.
- c. Burst pressure (without failure): 1,875 p.s.i.g. internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- d. Actuating pressure (increasing): 625 ± 25 p.s.i.g. to obtain electrical continuity between the connector pins "B" and "C".
- e. Deactuating pressure (decreasing): 50 p.s.i.d. maximum with respect to pressure of step d. above to obtain electrical continuity between connector pins "A" and "B".
- f. External leakage with 750 p.s.i.g. pneumatic pressure applied to the inlet port: None allowed.
- g. Operating temperature range: -65° to +165° F.
- h. Operating media: Gaseous nitrogen or air.
- i. Life cycles: 2,500 cycles of operation.

1.2 Electrical Performance Requirements. The electrical performance requirements of the switch are as follows:

- a. Subminiature switch details: Single-pole, double throw with a contact rating of 2.5 a. resistive load of 28 v.d.c. (CAUTION: Do not apply more than 0.5 a. resistive load to the switch during fabrication or testing.)
- b. Operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal.
- c. Closed circuit contact resistance between electrical connector pins "A" and "B" or "B" and "C": 0.5 ohm maximum. (NOTE: At no time shall both indicating circuits be open or closed at the same time.)
- d. Insulation resistance (500 v.d.c. test): 50 megohms minimum between each isolated electrical connector pin and the switch case or between connector pins when their respective switch contacts are fully open.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

REVISION DATE	(Continued on page 4)	20M30135
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INSTALLATION VIEW - 1.5 CUBIC FOOT HIGH PRESSURE
SPHERE ASSEMBLY 20M00877

LEGEND

- NOTES
- ① CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH NSFC-SPEC-164.
 - ② STAMP THE CURE DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH NSFC-STD-105.
 - ③ IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - ④ OR APPROVED EQUIVALENT.
 - ⑤ LOCKWIRE IN ACCORDANCE WITH MS33540.
 - ⑥ TORQUE 17 TO 19 INCH-POUNDS.
 - ⑦ LUBRICATE WITH DOW-CORNING CORP. D. C. 55 GREASE OR APPROVED EQUIVALENT.
 - ⑧ TORQUE TO 3 INCH-POUNDS.
 - ⑨ APPLY LOCK-TITE-A COMPOUND TO THREADS.
 - ⑩ TORQUE 40 TO 60 INCH-POUNDS.
 - ⑪ HOLD PRESSURE ADJUSTMENT SCREW AND TORQUE 17 TO 19 INCH-POUNDS.
 - ⑫ INSTALL WITH THE KEY IN THE POSITION SHOWN.
 - ⑬ SOLDER TO ELECTRICAL CONNECTIONS IN ACCORDANCE WITH NSFC-PROC-158.

20M30135

1. MS20995C32
2. #12-32-0.6094
3. 3758
4. 3746-1
- 5.
6. 3752
7. #12-32-0.3594
8. 6457
9. 6461
10. 6504
- 10.1 SW-1913
- 10.2 6462
11. #3-36
- 12.
13. 3822-3
14. MS25085-1
- 15.
16. #6-32
- 17.
18. 6493
19. #3-36-0.4844
20. #6-32-0.6719
21. #8-32-0.2636
- 22.
23. 3728
- 23.1 3702
- 23.2 AN526-1032-4
- 23.3 3724
- 23.4 3723
- 23.5 6345
- 24.
25. 3709
26. #12-32
27. #12-32-1.25
- 28.
29. #6-40-0.2344
30. MS20995C30
31. MS31028-148-77
32. SW1507-24
33. 6464
- 34.

750 P.S.I. PRESSURE SWITCH (SOUTHWESTERN INDUSTRIES INC., PS5100A) ① ② ③

- ① LOCKWIRE
- ② SCREW
- ③ INLET FITTING
- ④ SILICONE DIAPHRAM
- ⑤ ACTUATOR RETAINER
- ⑥ ACTUATOR ASSEMBLY
- ⑦ SCREW
- ⑧ COVER
- ⑨ GASKET
- ⑩ BRACKET ASSEMBLY
- ⑪ CLINCHING FASTENER
- ⑫ BRACKET
- ⑬ SELF LOCKING NUT
- ⑭ PLATE
- ⑮ SWITCH SWIM (FISHPAPER)
- ⑯ ELECTRICAL SWITCH
- ⑰ SWITCH SWIM
- ⑱ SELF LOCKING NUT
- ⑲ SPACER
- ⑳ SPACER
- ㉑ SCREW
- ㉒ SCREW
- ㉓ SCREW
- ㉔ RETAINING RING
- ㉕ SPRING ASSEMBLY
- ㉖ LEAF SPRING
- ㉗ TRUSS HEAD SCREW
- ㉘ SPRING FULCRUM
- ㉙ SPRING DRUM
- ㉚ TIP INSERT
- ㉛ SPRING WASHER
- ㉜ SPRING PIVOT PIN
- ㉝ LOCKNUT
- ㉞ PRESSURE ADJUSTMENT SCREW
- ㉟ THREADED INSERT
- ① SCREW
- ② LOCKWIRE
- ③ RECEPTACLE
- ④ ELECTRICAL WIRING (OIL-W-5086)
- ⑤ GASKET
- ⑥ CASE

DRAWN BY:	<i>B. Dumas</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30135	REVISION DATE OF THIS PAGE
PLANNER:	<i>A. Phillips</i>		E O's	
WRITER:	<i>G. Zschornig</i>			
APPROVED BY:	<i>M. Schmitt</i>		ART CONTROL NO. M-ME-E-1039	

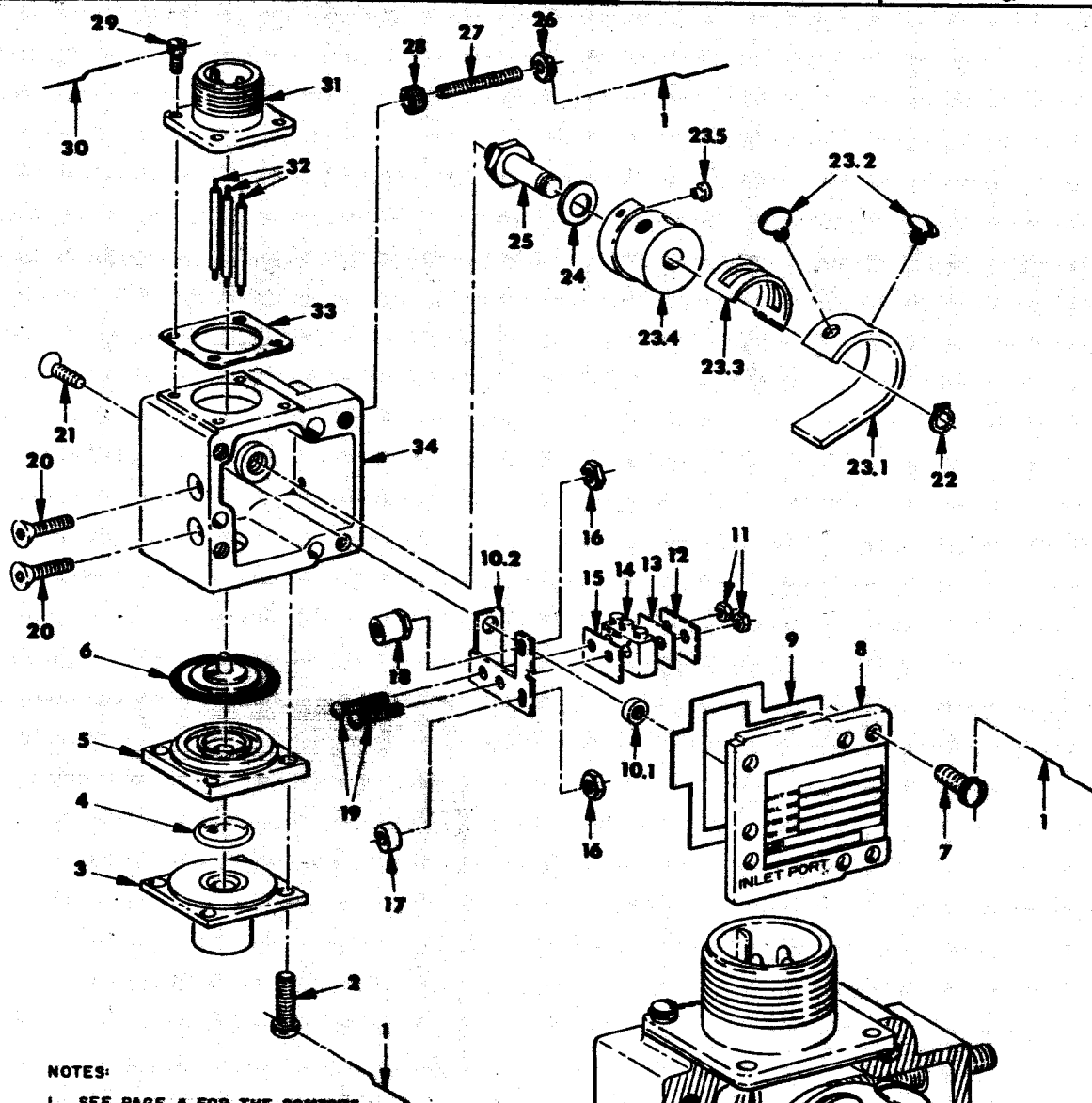
MANUFACTURING PLAN

PROCEDURE

MP1-2000

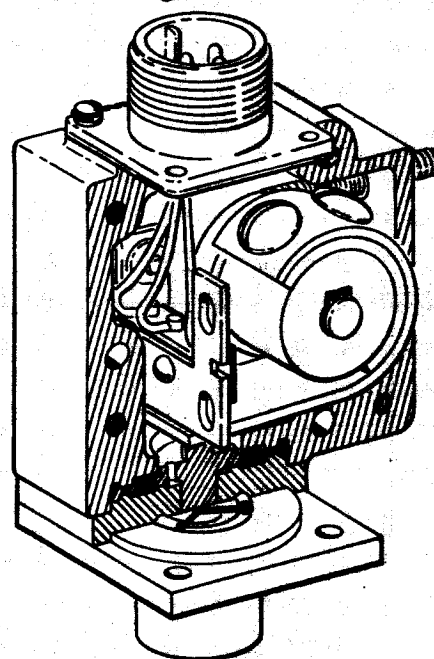
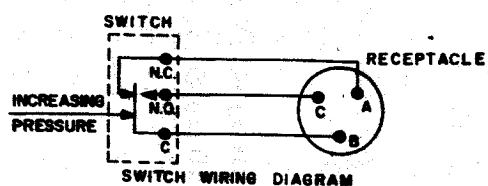
PAGE

3 of 4



NOTES:

1. SEE PAGE 4 FOR THE 20M30135 750 P.S.I. PRESSURE SWITCH EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ARE 3.96 BY 2.90 BY 1.97 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 0.75 POUND.



REVISION DATE

M-ME-E-1089

20M30135

MSFC - Form 1151-2 (June 1961)

- 1.3 Shock Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance while pressurized pneumatically to 750 ± 10 p.s.i.g., six shocks (three in each direction) of one of the following durations and wave forms at 65 g's in each of the three major axes:
- 10-milliseconds duration - triangular wave, or
 - 8-milliseconds duration - sine wave, or
 - 6-milliseconds duration - square wave.
- 1.4 Vibration Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance while pressurized pneumatically to 750 ± 10 p.s.i.g., vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:
- 20 to 55 c.p.s. at 5 g's,
 - 55 to 95 c.p.s. at 0.03-inch double amplitude displacement, and
 - 95 to 2,000 c.p.s. at 15 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the switch are outlined in Performance Specification 10M01378 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858
MIL-W-5086
NASA - MSFC-PROC-158
MSFC-SPEC-164

3.2 Standards:

Military - MIL-STD-130
MS33540
NASA - MSFC-STD-105
Army Ballistic Missile
Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302
10509303
MSFC - 10M01378

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	
SA-6	
SA-7	
SA-8	
SA-9	
SA-10	
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30135

REVISION DATE

MSFC - Form 1151-1 (June 1961)

SUMMARY SHEET	
Nomenclature Switch, High Pressure	
Drawing Numbers: 10414029, 20M30130	Vendor: Southwestern Ind.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $20,120 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 79 Total Number of Failures Reported: 57	MCBF (in cycles): 49.7 Total Cycles of Operation: 2838* Vehicle Equipment: X Ground Equipment:

December 1965

* Minimum operating time - Several component
 serial numbers do not appear in cycle logs.

II.17.6
 Page 1 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating	<u>1</u>	Binding:
	Intermittent		Broken/Cracked:
<u>1</u>	Inoperative		Broken/Ruptured:
<u>2</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
<u>1</u>	Operation Sluggish		Other: _____
<u>40</u>	Out of Specs		Dead spot <u>3</u>
	Oil/Moisture Saturation		<u>Incomplete information-</u>
<u>4</u>	Sticking		<u>1</u>
	Would Not Open		
<u>1</u>	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-2 through SA-10 (less flight data)	

DATA SHEET	
Nomenclature: Switch, High Pressure	
Drawing Numbers: 10414029	Vendor: Southwestern Ind.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $23,310 \times 10^{-6}/cy.$	MCEF (in cycles): 42.9
Number of Components this Data Represents: 31	Total Cycles of Operation: 944*
Number of Failures Reported: 22	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: Six shocks at 65 g, 6 ms square wave.	
High Temperature: 160°F	
Low Temperature: -140°F	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: No leakage allowable	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: 20-55 cps at 5 g; 55-110 cps at 0.03 in. D.A.d. 110-2000 cps at 20 g	

December 1965

II.17.6

* Minimum operating time - serial number
25276, 22400, 22000, 25359, 25309, 25252,
22409, 25311, 25357 do not appear in cycle logs.

Page 3 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>19</u>	Out of Specs	<u>1</u>	<u>Incomplete information</u>
	Oil/Moisture Saturation		_____
<u>1</u>	Sticking		_____
	Would Not Open		
<u>1</u>	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2, SA-3, and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Memo No. IN-P&VE-E-62-5, January 21, 1962			

II.17.6

Page 4 of 16

Additional information concerning the 10414029 component:

Most of "out of specification" failures fell into the following ranges outside of tolerance.

No.	psig High	No.	psig Low
4	12 - 20	3	10 - 80
4	35 - 154	4	90 - 150

Of the 22 complaints, six were reported on the Unsatisfactory Condition Reports and 16 were reported on the Inspection Reports.

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MSFC		MANUFACTURING ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN				DATE	PROCEDURE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414029 HIGH PRESSURE SWITCH				10 May 1962	EP-140
				APPROVED <i>R. Gurf.</i>	PAGE 1 of 4

1. DESCRIPTION.

The high pressure switch 10414029 is a single-pole, double throw high pressure OK switch that indicates both increasing and decreasing pressures within the range specified below. The switch is a component on the fuel container pressurization system, S-V dummy stage water ballast system, helium system, control pressure system, and air bearing GN₂ supply system. One switch is used in each of the systems stated except for the air bearing GN₂ supply system on vehicles SA-3 and -4 that uses one switch for the ST-90 and another for the ST-124 stabilized platform air bearing supply sphere assemblies. The switches are installed on the radial beam between fins I and II on the spider beam in the fuel container pressurization system, payload section high pressure sphere assembly, fin II of the spider beam in the helium bottle assembly, control pressure high pressure sphere assembly in the rear skirt of container F2, and air bearing GN₂ supply system high pressure sphere assemblies on the forward side of the spider beam on fin I and on the radial beam between fins III and IV as shown in the installation views. The various functional characteristics of the high pressure switch are as follows:

- 1.1 Mechanical Performance Characteristics. The switch is capable of performing mechanically as follows:
 - a. Operating pressure: 3,100 p.s.i.g. internal pneumatic pressure.
 - b. Proof operating pressure: 5,000 p.s.i.g. internal pneumatic pressure.
 - c. Burst pressure (without rupture): 7,500 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
 - d. Actuating pressure (increasing): 3,050 ± 61 p.s.i.g. to obtain continuity between electrical connector pins "B" and "C".
 - e. Deactuating pressure (decreasing): 2,600 p.s.i.g. minimum to obtain continuity between electrical connector pins "A" and "B".
 - f. Leakage with 3,100 p.s.i.g. maximum internal pneumatic pressure applied: None
 - g. Operating temperature range: -40° to +160° F.
 - h. Operating media: Air, helium, or gaseous nitrogen.
- 1.2 Electrical Performance Requirements. The electrical performance requirements of the switch are as follows:
 - a. Insulation resistance (500 V. test): 50 megohms minimum between the electrical connector pins (circuit open) and between each pin and the switch case.
 - b. Rating: 2.5 a. inductive load at 18 to 30 v.d.c.

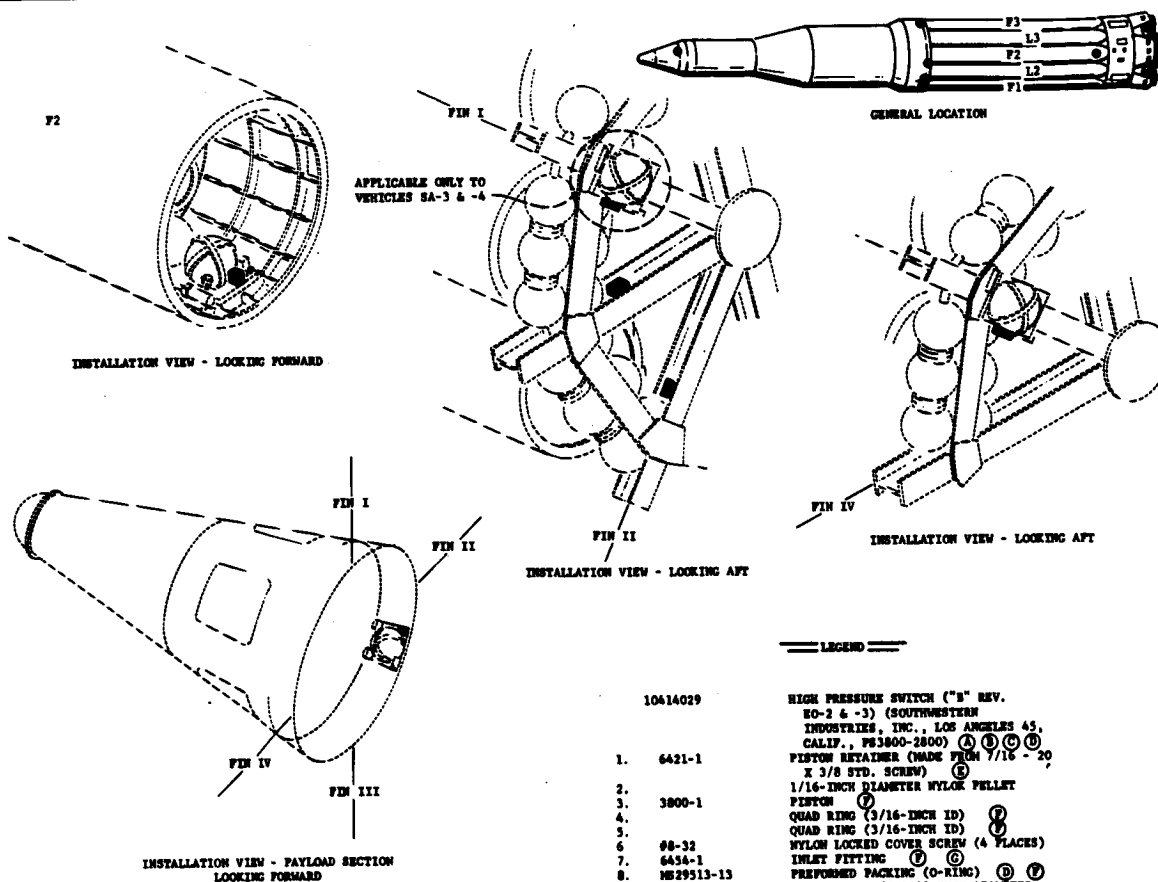
REVISION DATE
26 OCT 1962

(Continued on page 4)

10414029

MSFC - Form 1151 (June 1961)

II.17.6
Page 7 of 16



- == NOTES ==
- A CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
 - B STAMP THE CURE DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
 - C IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
 - D OR APPROVED EQUIVALENT.
 - E TORQUE 135 TO 150 INCH-POUNDS.
 - F LUBRICATE WITH DOW-CORNING CORP. D.C.33 SILICONE GREASE OR APPROVED EQUIVALENT.
 - G PACK RELIEF VENT WITH DOW-CORNING CORP. D.C.33 SILICONE GREASE OR APPROVED EQUIVALENT.
 - H TORQUE 16 TO 20 INCH-POUNDS.
 - I SOLDER ELECTRICAL CONNECTIONS IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300.
 - J TORQUE 30 TO 40 INCH-POUNDS.
 - K LOCKWIRE IN ACCORDANCE WITH MS33540.

10414029

1. 6421-1
2. 3800-1
3. 3800-1
4. 3800-1
5. 3800-1
6. 98-32
7. 6434-1
8. MS29513-13
9. 3800-1
10. 3815
11. 3811-3
12. 6395
13. 64-40
14. 6471
15. 3812
16. 3821
17. 62-56
18. 3825
19. 13M1
20. 3822-3
21. 96-32
22. 96-32
23. 3824
24. 3803
25. 3585-04CH-1
26. 3819
27. 6422
28. 3819
29. MS20995C32
30. 6347
31. 3802

HIGH PRESSURE SWITCH ("B" REV.
EO-2 & -3) (SOUTHWESTERN
INDUSTRIES, INC., LOS ANGELES 45,
CALIF., PS3800-2800) (A) (B) (C) (D)
PISTON RETAINER (MADE FROM 7/16 - 20
X 3/8 STD. SCREW) (E)
1/16-INCH DIAMETER NYLON PELLETT
PISTON (F)
QUAD RING (3/16-INCH ID) (G)
QUAD RING (3/16-INCH ID) (H)
NYLON LOCKED COVER SCREW (4 PLACES)
INLET FITTING (I) (J)
PREFORMED PACKING (O-RING) (K) (L)
PISTON BALL (0.125-INCH DIAMETER-
STEEL)
SWITCH BALL (0.1250-INCH DIAMETER-
STEEL)
PISTON BALL GUIDE
SPRING SEAT
COMPRESSION SPRING
NYLON LOCKED COVER SCREW
NAMEPLATE
COVER PLATE
COVER PLATE GASKET (M)
LOCK NUT (2 PLACES)
AUXILIARY ACTUATOR (MADE FROM
MINNEAPOLIS HONEYWELL AUXILIARY
ACTUATOR JS-10000)
MILLI-SWITCH (MILLI-SWITCH CO.
FRANKFORD, IND.) (N)
SWITCH SHIM (FISHPAPER)
SCREW (O)
SCREW (P)
WASHER
SPECIAL WASHER
ADJUSTING PLATE
SCREW LOCKING INSERT (HELI-COIL)
(2 PLACES) (Q)
ELECTRICAL WIRING (R)
DOME PIN
THREADER STEEL INSERT
SPRING ADJUSTMENT SCREW (MADE FROM
1-28NF X 1 1/2 STEEL STD. SOCKET HEAD
SET SCREW. ANNEALED BEFORE MACHINING)
LOCKNUT (MADE FROM STD. 1-28NF HEXAGON
JAM NUT) (S)
LOCKWIRE (T)
ELECTRICAL CONNECTOR (CANNON
GEO2-108L-3P-003) (U)
ROLL PIN (TO FIT 0.046-TO 0.056-INCH
DIAMETER HOLE) (3 PLACES)
MACHINED HOUSING (MADE FROM 3816
CASTING)

DRAWN BY:	<i>Charles E. Whaley</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414029	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. E. Bennett</i>		EO's	-2 and -3	
WRITER:	<i>A. L. Schmitt</i>	B	ART CONTROL NO.	M-MS-EP140-739	
APPROVED BY:	<i>M. S. Sigheeth</i>				

DATA SHEET	
Nomenclature: Switch, High Pressure	
Drawing Numbers: 20M30130	Vendor: Southwestern Ind.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $18,484 \times 10^{-6}/cy.$	MGBF (in cycles): 54.1*
Number of Components this Data Represents: 48	Total Cycles of Operation: 1894
Number of Failures Reported: 35	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Reference page 3, II.17.6	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

*Minimum operating time - Serial numbers 25436 and 25454 do not appear in cycle logs.

II.17.6

Page 9 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>3</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating	<u>1</u>	Binding:
	Intermittent		Broken/Cracked:
<u>1</u>	Inoperative		Broken/Ruptured:
<u>2</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
<u>1</u>	Operation Sluggish		Other: _____
<u>21</u>	Out of Specs	<u>3</u>	<u>Dead Spot</u>
	Oil/Moisture Saturation		_____
<u>3</u>	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-5 through SA-10 Vehicles (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30130 component:

Most of "out of specification" failures fell into the following ranges outside of tolerance:

No.	psig High	No.	psig Low
2	18 - 19	7	10 - 35
		6	53 - 500

Eleven failures were reported on the Unsatisfactory Condition Reports and twenty-four failures reported on the Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30130 HIGH PRESSURE SWITCH		1 February 1963
APPROVED <i>J. F. [Signature]</i>		PROCEDURE MPI-2000
		PAGE 1 of 4

1. DESCRIPTION.

The high pressure switch 20M30130 is a high pressure OK switch that indicates both increasing and decreasing pressures within the range specified below. The switch is a component of the fuel container pressurization system, LOX and fuel slosh measurement helium system, control pressure system, and gas (formerly air) bearing GN₂ supply system. One switch is used in each of the systems stated except the gas bearing GN₂ supply system that uses one switch on the ST-90 and another on the ST-124 stabilized platform high pressure sphere assembly 20M00976. In the fuel container pressurization system, the switch is installed on the D-139 pressure gage assembly 10M10290. In the LOX and fuel slosh measurement helium system, the switch is installed on the pressure bottle mounting assembly 20M00925. In the GN₂ control pressure system, the switch is installed on the 1.5 cubic foot high pressure sphere assembly 20M00877. The switch is located in the 154-inch instrument unit assembly, forward skirt of container L2, and rear and forward skirts of container F3 as shown in the installation views. The various functional characteristics of the switch are as follows:

1.1 Mechanical Performance Characteristics. The switch is capable of performing mechanically as follows:

- a. Operating pressure: 3,100 p.s.i.g. internal pneumatic pressure.
- b. Proof operating pressure: 4,650 p.s.i.g. internal pneumatic pressure.
- c. Burst pressure (without rupture): 7,750 p.s.i.g. minimum internal pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- d. Actuating pressure (increasing): $2,835 \pm 100$ p.s.i.g. to obtain continuity between electrical connector pins "B" and "C".
- e. Deactuating pressure (decreasing): 2,600 p.s.i.g. minimum to obtain continuity between electrical connector pins "A" and "B".
- f. Operating temperature range: -40° to +160° F.
- g. Operating media: Air, helium, or gaseous nitrogen.
- h. Storage temperature withstanding capability: -65° F.
- i. Life cycle withstanding capability: 2,500 cycles of operation.

1.2 Electrical Performance Requirements. The electrical performance requirements of the switch are as follows:

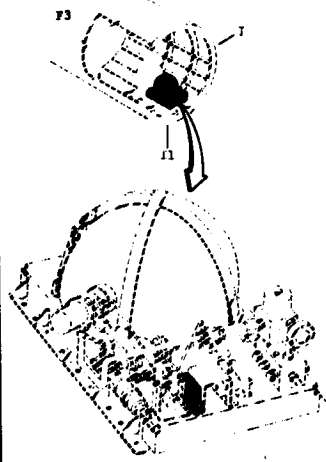
- a. Insulation resistance (500 V. test): 50 megohms minimum between the electrical connector pins (circuit open) and between each connector pin and the switch case.
- b. Subminiature indicating switch details: Single-pole, double throw with an inductive load rating of 2.5 a. at 28 v.d.c.
- c. Circuit resistance: 0.5 ohm maximum between electrical connector pins "A" and "B" (circuit closed) and pins "B" and "C" (circuit closed).
- d. Operating voltage range: 22 to 32 v.d.c. with 28 v.d.c. nominal.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

REVISION DATA
8 MAR 63

(Continued on page 4)

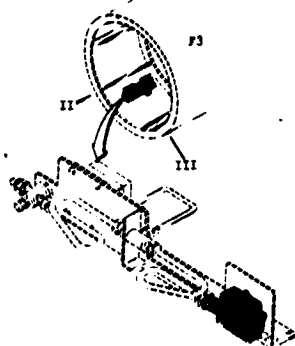
20M30130



INSTALLATION VIEW - 1.5 CUBIC FOOT HIGH
PRESSURE SPHERE ASSEMBLY 20M00877



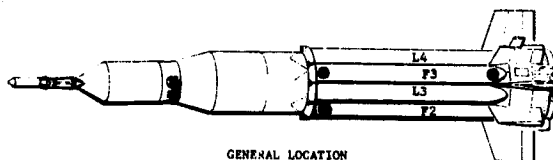
INSTALLATION VIEW - ST-90 AND ST-124 HIGH
PRESSURE SPHERE ASSEMBLY 20M00976



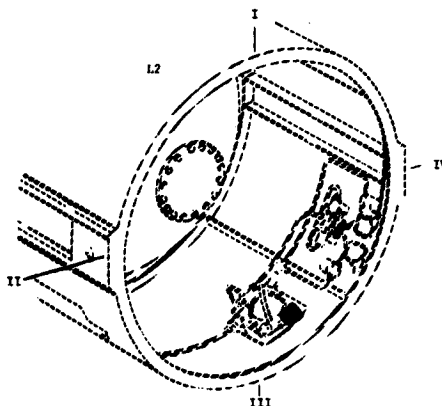
INSTALLATION VIEW - D-139 PRESSURE GAGE
ASSEMBLY 10M10290

NOTES

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES EXCEPT ELECTRICAL COMPONENTS, IN ACCORDANCE WITH MSFC-SPFC-164.
- (B) STAMP THE CURVE DATE OF THE OLDEST PREFORMED PACKING RUBBER SEAL IN ACCORDANCE WITH MSFC-STD-103.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) OR APPROVED EQUIVALENT.
- (E) TORQUE 135 TO 150 INCH-POUNDS.
- (F) LUBRICATE WITH DOW-CORNING CORP. D. C. 55 SILICONE GREASE OR APPROVED EQUIVALENT.
- (G) PACK RELIEF VENT WITH DOW-CORNING CORP. D. C. 55 SILICONE GREASE OR APPROVED EQUIVALENT.
- (H) TORQUE 16 TO 20 INCH-POUNDS.
- (I) SOLDER ELECTRICAL CONNECTIONS IN ACCORDANCE WITH MSFC-PROC-158.
- (K) TORQUE 30 TO 40 INCH-POUNDS.
- (L) LOCKWIRE IN ACCORDANCE WITH MS33540.



GENERAL LOCATION



INSTALLATION VIEW - PRESSURE BOTTLE MOUNTING
ASSEMBLY 20M00925

LEGEND

- | | |
|-------------------|--|
| 20M30130 | HIGH PRESSURE SWITCH (EO-1) (SOUTHWESTERN INDUSTRIES, INC., LOS ANGELES 43, CALIF., PS3800-2800) (A) (B) (C) (D) |
| 1. 6421-1 | POSITION RETAINER (MADE FROM 7/16 - 20 x 3/8 STD. SCREW) (E) |
| 2. 3800-1 | 1/16-INCH DIAMETER NYLON PELLET |
| 3. 3800-1 | PISTON (F) |
| 4. 3800-1 | QUAD RING (3/16-INCH ID) (G) |
| 5. 3800-1 | QUAD RING (3/16-INCH ID) (H) |
| 6. 08-32 | NYLON LOCKED COVER SCREW (4 PLACES) (I) |
| 7. 6434-1 | INLET FITTING (J) |
| 8. MS29513-13 | PREFORMED PACKING (O-RING) (K) (L) |
| 9. 3825 | PISTON BALL (0.3125-INCH DIAMETER - STEEL) |
| 10. 3815 | SWITCH BALL (0.1250-INCH DIAMETER - STEEL) |
| 11. 3815 | PISTON BALL GUIDE |
| 12. 3811-3 | SPRING SEAT |
| 13. 6395 | COMPRESSION SPRING |
| 14. 04-40 | NYLON LOCKED COVER SCREW |
| 15. 6471 | NAMEPLATE |
| 16. 3812 | COVER PLATE |
| 17. 3821 | COVER PLATE GASKET (M) |
| 18. 02-36 | LOCK NUT (2 PLACES) (N) |
| 19. 3825 | AUXILIARY ACTUATOR (MADE FROM MINNEAPOLIS HONEYWELL AUXILIARY ACTUATOR J8-10000) |
| 20. 18M1 | MILLI-SWITCH (MILLI-SWITCH CO. FRANKFORD, IND.) (O) |
| 21. 3822-3 | SWITCH SHIM (FISHPAPER) |
| 22. 06-32 | SCREW (P) |
| 23. 06-32 | SCREW (Q) |
| 24. 3824 | WASHER |
| 25. 3824 | SPECIAL WASHER |
| 26. 3803 | ADJUSTING PLATE |
| 27. 3585-06CN-1/4 | SCREW LOCKING INSERT (HELI-COIL) (2 PLACES) (R) |
| 28. 6422 | ELECTRICAL WIRING (MIL-W-5086) (S) |
| 29. 3819 | DOWEL PIN |
| 30. 6422 | THREADED STEEL INSERT |
| 31. 6422 | SPRING ADJUSTMENT SCREW (MADE FROM 1/4-28NF x 1-1/4 STEEL STD. SOCKET HEAD SET SCREW. ANNEALED BEFORE MACHINING) |
| 32. 3819 | LOCKNUT (MADE FROM STD. 1/4-28NF HEXAGON JAM NUT) (T) |
| 33. MS20995C32 | LOCKWIRE (U) |
| 34. 6347 | ELECTRICAL CONNECTOR (CANNON GS02-108L-3P-003) (V) |
| 35. 3802 | ROLL PIN (TO FIT 0.046- TO 0.056-INCH DIAMETER HOLE) (3 PLACES) |
| 36. 3802 | MACHINED HOUSING (MADE FROM 3816 CASTING) |

DRAWN BY: <i>W.J. Smith</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30130	REVISION DATE OF THIS PAGE
PLANNER: <i>A. Phillips</i>		EO's -1	31 May 1963
WRITER: <i>G. Spelink</i>			
APPROVED BY: <i>J. V. V. V.</i>		ART CONTROL NO. M-ME-E-1041	

MANUFACTURING PLAN

PROCEDURE

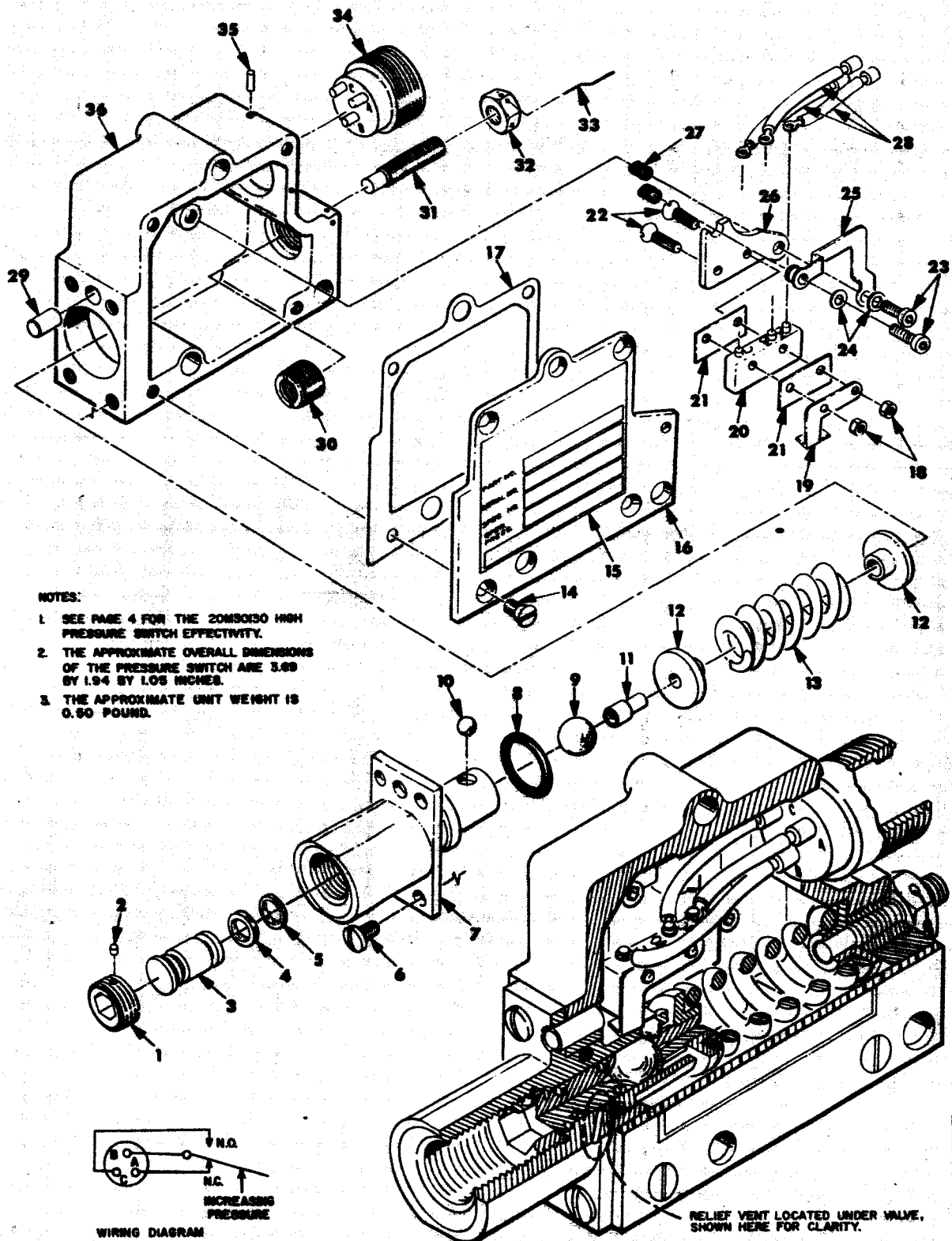
MPI-2000

PAGE

3

OF

4



REVISION DATE 31 May 1963

M-ME-E-1041-A

20M30130

MSFC - Form 1151-2 (June 1961)

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Page 15 of 16

- 1.3 Shock Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance while pressurized pneumatically to a minimum of 3,100 p.s.i.g., six shocks of one of the following durations and wave forms at 65 g's in each of the three major axes:
- 10-milliseconds duration - triangular wave, or
 - 8-milliseconds duration - sine wave, or
 - 6-milliseconds duration - square wave.
- 1.4 Vibration Withstanding Capability. The switch is designed to withstand, without damage or impairment of performance while pressurized pneumatically to a minimum of 3,100 p.s.i.g., vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:
- 20 to 55 c.p.s. at 3.0 g's,
 - 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 - 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the switch are outlined in Performance Specification 10M01147 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858
NASA - MSFC-SPEC-164
MSFC-PROC-158

3.2 Standards:

Military - MIL-STD-130
MS33540
Army Ballistic Missile
Agency - ABMA-STD-18
NASA - MSFC-STD-105

3.3 Drawings:

Ordnance Corps - 10509302
10509303
MSFC - 10M01147

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	EO-1
SA-6	EO-1
SA-7	EO-1
SA-8	EO-1
SA-9	EO-1
SA-10	EO-1
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30130

REVISION DATE

SUMMARY SHEET	
Nomenclature Switch, Step Pressure (fuel)	
Drawing Numbers: 10414081, 20M30154	Vendor: Servomechanism Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: $15,822 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 14 Total Number of Failures Reported: 12	MCBF (in cycles): 63.2 Total Cycles of Operation: 759 Vehicle Equipment: X Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>11</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>1</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ <u>Output voltage Unstable</u> _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-2 through SA-5 Vehicles (less flight data)	

DATA SHEET	
Nomenclature: Switch, Step Pressure (fuel)	
Drawing Numbers: 10414081	Vendor: Servomechanisms Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: 45,045 $\times 10^{-6}$ /cy.	NCBF (in cycles): 22.2
Number of Components this Data Represents: 7	Total Cycles of Operation: 222
Number of Failures Reported: 10	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: 3 shocks 35 g in planes, 1 psi above and below actuation	
High Temperature: 165°F	
Low Temperature: -65°F	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Non-operating 20-55 cps at 5 g, 55-110 cps at Vibration: 0.03" D.A.d., 110-2000 cps at 20 g	

December 1965

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Page 3 of 14

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>9</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>1</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ <u>Output voltage un-</u> <u>stable</u> _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: MSFC Report No. IN-P&VE-E-65-2, January 21, 1962			

Additional information concerning the 10414081 component:

The normally open fuel step pressure switch is calibrated to sense, through pressure, a predetermined filling level in the fuel tanks. When the switch becomes actuated, its closed contacts cause a ground system indicator to become energized. The switch signals to GSE that the fuel level has exceeded 100% full.

1. Vendor - Servomechanisms, Inc. Western Division,
Part No. 81608, Type TR 2125
2. Location - Station 210 in fuel tank No. 3
3. Service - GN_2 fuel vapor and RP-1 fuel
4. Temperature - Operating: - 65 to 165°F
5. Pressure -
 - a. Operating: The switch has one switching point, 15 psig; the switching point is adjusted by exchanging calibrated resistors
 - b. Line pressure: 65 psig minimum
 - c. Burst pressure: 160 psig minimum, both ports simultaneously
 - d. Pressure differential: 30 psig minimum (normal), 20 psig minimum (reverse)
6. Leakage - No external leakage or leakage between ports
7. Electrical Characteristics -
 - a. Switch:
 - (1) Type: Solid state
 - (2) Operating voltage: 22 to 32 vdc, 28 vdc nominal
 - (3) Accuracy: Indicates within 0.5% of nominal pressure setting at 26 to 30 vdc, within 1.0% at 22 to 26 vdc and 30 to 32 vdc

- (4) Decreasing pressure: Indicates within 0.3 psig of increasing pressure setting at 26 to 30 vdc, within 0.45 psig at 22 to 26 vdc and 30 to 32 vdc
- b. Heater:
 - (1) Control: Thermostat
 - (2) Operating voltage: 100 to 120 vdc, 60 cycles, single phase, 110 vdc nominal
 - (3) Power: 80 watts maximum
- c. Thermostat: Snap action type
- d. Insulation resistance: 50 megohms minimum, between all pin connections and switch body
- e. Indicating element operating voltage: 28 vdc nominal, and a maximum of 400 millivolt ripple

Nine failures were reported on the Inspection Reports;
one was reported on an Unsatisfactory Condition Report.

December 1965

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Page 6 of 14

DATA SHEET	
Nomenclature: Switch, Step Pressure (fuel)	
Drawing Numbers: 20M30154	Vendor: Servomechnaisms Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2000 cy.	
Failure Rate: 3724 x 10 ⁻⁶ /cy.	MCHF (in cycles): 268.5
Number of Components this Data Represents: 7	Total Cycles of Operation: 537
Number of Failures Reported: 2	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as page 3, II.17.7	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

II.17.7
Page 7 of 14

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>2</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30154 component:

Two failures were reported on Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 28 June 1963
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30154 FUEL STEP PRESSURE SWITCH ASSEMBLY		PROCEDURE MPI-2000
		APPROVED <i>P. Duff</i>
		PAGE 1 of 4

1. DESCRIPTION.

The fuel step pressure switch assembly 20M30154 is a component of the fuel fill and drain system. The switch assembly is used to give an output indication that energizes an indicator showing that the fuel has reached a specific predetermined filling level. A solid state switch is used as the indicating element in the switch assembly. Also the switch assembly incorporates an integral thermostat and heater. Adjustment of the switch assembly output indication differential pressure is accomplished by exchanging calibrated resistors. The switch assembly is located in the aft skirt of container F4 as shown in the installation view. The various functional characteristics of the pressure switch assembly are as follows:

1.1 Operating Characteristics. The operating characteristics of the switch assembly are as follows:

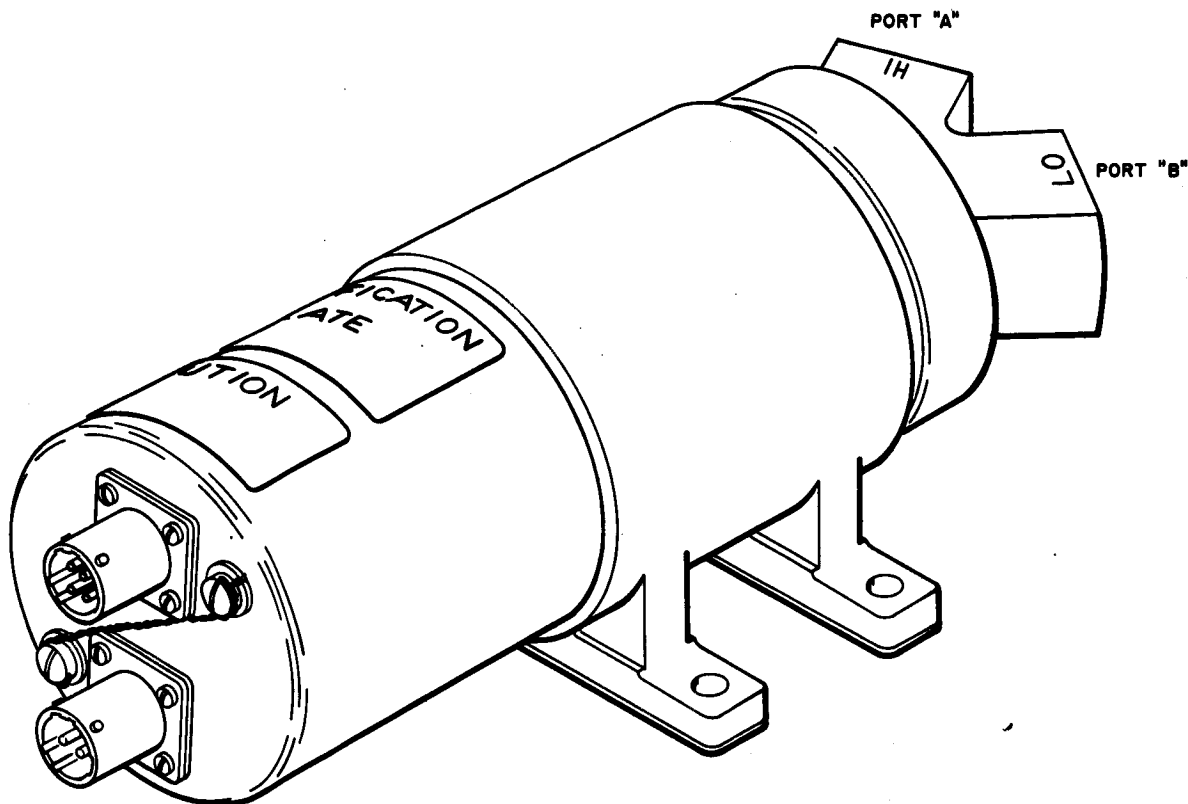
- a. Operating media: Air, gaseous nitrogen, and RP-1 fuel or fuel vapor.
- b. Operating temperature range: -65° to +165° F.
- c. Proof pressures without leakage between ports or external leakage:
Normal differential - minimum at port "A" is 30 p.s.i. greater than at port "B." Reverse differential - minimum at port "B" is 20 p.s.i. greater than at port "A."
- d. Burst pressure (without rupture): 160 p.s.i.g. minimum applied to both ports simultaneously. (CAUTION: Use only for destructive acceptance testing.)
- e. Line operating pressure: 65 p.s.i.g. applied to both ports simultaneously.
- f. Increasing indication differential pressure setting: 18.84 p.s.i.g. (obtained by exchanging calibrated resistors).
- g. Decreasing indication differential pressure setting: Within 0.3 p.s.i. of pressure specified in step f. at supply voltages of 26 to 30 v.d.c.; 0.45 p.s.i. with supply voltages of 22 to 26 v.d.c. or 30 to 32 v.d.c.
- h. Switch accuracy: $\pm 0.5\%$ of nominal pressure setting at supply voltages from 26 to 30 v.d.c.; $\pm 1.0\%$ at supply voltages from 22 to 26 v.d.c. or 30 to 32 v.d.c.

1.2 Electrical Performance Characteristics. The switch assembly is capable of performing electrically as follows:

- a. Indicating element: Solid state switch.
- b. Indicating element operating voltage: 22 to 32 v.d.c. with 28 v.d.c. nominal and a maximum of 400 millivolt ripple.
- c. Heater operating voltage: 100 to 120 volt, 60 cycle, single phase system with 110 v.a.c. nominal.
- d. Heater control: Snap action type thermostat.
- e. Heater power: 80 watts maximum.
- f. Insulation resistance: 50 megohms minimum between each electrical connector pin and the switch body with 500 v.d.c. applied.
- g. Switch indication: With the inlet differential pressure greater than the pressure setting - output is 0 v.d.c. +0.5 v.d.c. or -0 v.d.c. with a 200 ± 20 ohms resistive load. With inlet

(Continued on Page 4)

20M30154



NOTES:

1. SEE PAGE 4 FOR THE 20M30154 FUEL STEP PRESSURE SWITCH ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ASSEMBLY ARE 2.47 BY 3.03 BY 7.00 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 2.58 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

SWITCH & HEATER RECEPTACLE CONNECTOR PIN FUNCTIONS

RECEPTACLE	PIN NO.	PIN FUNCTION
PT02-E-8-4P (SWITCH CONNECTOR)	A	28V.D.C.-NEG., INPUT & OUTPUT
	B	28V.D.C.-POS., INPUT
	C	28V.D.C.-POS., SWITCH OUTPUT
	D	BLANK
PT02-E-8-2P (HEATER CONNECTOR)	A	115V.A.C.-HIGH
	B	115V.A.C.-LOW

DRAWN BY:	<i>H.M. Pinker</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30154	REVISION DATE OF THIS PAGE
PLANNER:	<i>J.P. Phillips</i>	A	EO'S	
WRITER:	<i>A. G. Schaub</i>		-3	
APPROVED BY:	<i>M. W. Hightower</i>		ART CONTROL NO. M-ME-E-1195	

MSFC - Form 1151-1 (June 1961)

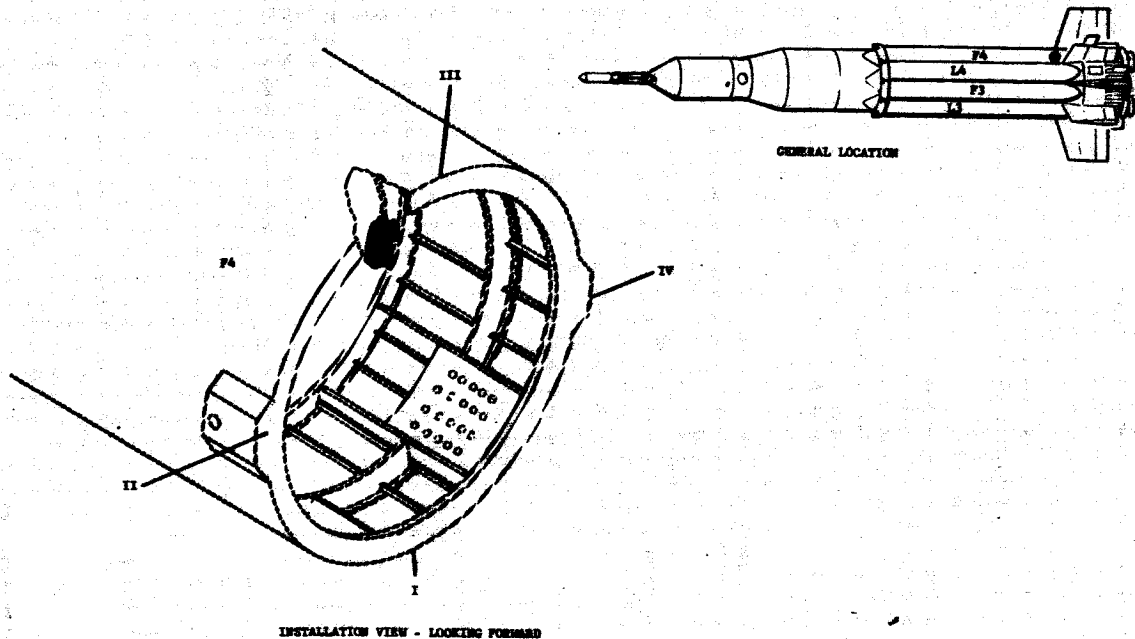
MANUFACTURING PLAN

PROCEDURE

MPI-2000

PAGE

3 of 4



NOTES

- ① IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- ② STAMP THE CURB DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH MSFC-STD-105.
- ③ CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- ④ OR APPROVED EQUIVALENT.
- ⑤ CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
- ⑥ PERFORM RECEIVING AND INSTALLATION INSPECTION IN ACCORDANCE WITH PROCEDURE 20M30334 (EO-1).

20M30154

LEGEND

FUEL STEP PRESSURE SWITCH ASSEMBLY
 ("A" REV. & EO-3) (SERVOMECHANISMS
 INC., 200 AVIATION BLVD., EL
 SEGUNDO, CALIF., PART 816106,
 TYPE TR2125) ① ② ③ ④ ⑤ ⑥

REVISION DATE

M-ME-E-1195

20M30154

1.2 (con.)

pressure less than the pressure setting - voltage drop is 2 v.d.c. maximum with a 200 ± 20 ohms resistive load.

1.3 Life Cycle. The switch assembly is capable of operating a minimum of 5,000 cycles without damage or impairment of performance.

CAUTION: Paragraphs 1.4, 1.5, and 1.6 constitute destructive test items that are performed only at the option of the procuring activity.

1.4 Shock Withstanding Capability. The switch assembly is designed to withstand, without damage or impairment of performance, six shocks (three in each direction) of one of the following durations and wave forms at 35 g's in each of the three major axes with both ports pneumatically pressurized to 65 p.s.i.g.:

10-milliseconds duration - triangular wave, or 8-milliseconds duration - sine wave, or 6-milliseconds duration - square wave.

1.5 Nonoperating Vibration Withstanding Capability. The switch assembly is designed to withstand without operating, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes with both ports pneumatically pressurized to 65 p.s.i.g. under the following conditions:

20 to 55 c.p.s. at 3.0 g's, 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and 100 to 2,000 c.p.s. at 10.0 g's.

1.6 Operating Vibration Withstanding Capability. The switch assembly is designed to withstand while operating, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes while connected electrically and pneumatically under the following conditions:

20 to 2,000 c.p.s. at 2.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for the delivery of the switch assembly are outlined in Performance Specification 10M01396, MSFC Receiving and Installation Inspection Procedure 20M30334, and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-164
Military - MIL-W-16878

3.2 Standards:

Military - MIL-STD-130, & MS33586
NASA - MSFC-STD-105

3.3 Drawings:

Ordnance Corps - 10509302; MSFC - 10419909, 10M01396, & 20M30334

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	"A" Rev. and EO-3
SA-6	"A" Rev. and EO-3
SA-7	"A" Rev. and EO-3
SA-8	Not Applicable
SA-9	Not Applicable
SA-10	Not Applicable
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30154

REVISION DATE

SUMMARY SHEET	
Nomenclature Switch (Thrust OK Pressure)	
Drawing Numbers: 10480716, 20M50830, 20M50242, 60C27818, 60C20278 Saturn I Vehicle	Vendor: Frebank Co. Location: S-I Stage
Estimated Design Life: 2500 cy.	
Failure Rate: $1730 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 89 Total Number of Failures Reported: 6	MCBF (in cycles): 577.8 Total Cycles of Operation: 3467 Vehicle Equipment: X Ground Equipment:

December 1965

II.17.8
Page 1 of 18

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
<u>3</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
<u>3</u>	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-2 through SA-10 Vehicles (less flight data)	

DATA SHEET	
Nomenclature: Switch (Thrust OK Pressure)	
Drawing Numbers: 10480716	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2500 cy.	
Failure Rate: $6020 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 166.1
Number of Components this Data Represents: 8	Total Cycles of Operation: 230
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-2 Vehicle (less flight data)			
CALENDAR TIME DATA REPRESENTS:			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Switch (Thrust OK Pressure)	
Drawing Numbers: 20M50242	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2500 cy.	
Failure Rate: 6329 x 10 ⁻⁶ /cy.	MCBF (in cycles): 158
Number of Components this Data Represents: 17	Total Cycles of Operation: 788
Number of Failures Reported: 5	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>3</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections
	Operation Sluggish		Shorted:
<u>2</u>	Out of Specs		Other: _____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		_____
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Switch (Thrust OK Pressure)	
Drawing Numbers: 20M50830	Vendor: Frebank Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2500 cy.	
Failure Rate: $1189 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 840.4
Number of Components this Data Represents: 22	Total Cycles of Operation: 1164
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

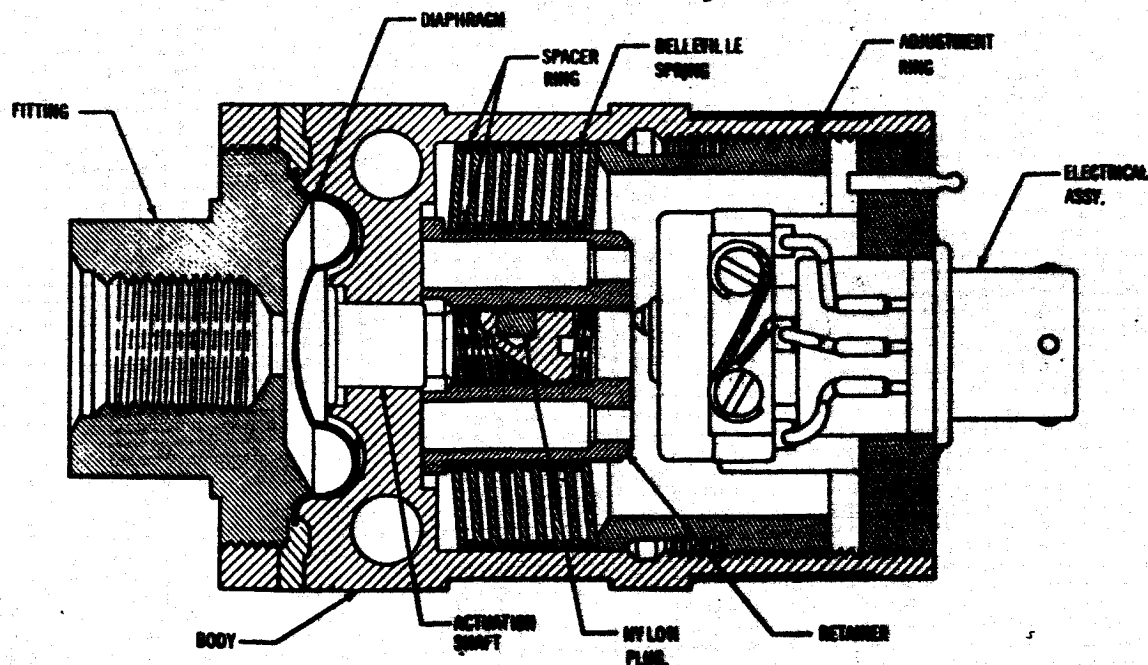
II.17.8
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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-5 through SA-7 Vehicles (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Thrust OK Pressure Switch, Part No. 20M50830

The thrust OK pressure switch initiates an actuation signal to cut off all engines when there is a significant pressure drop in the fuel discharge line.

1. Vendor - Frebank Company, Part No. 4192-2
2. Location - Station 94
3. Service - RP-1 fuel
4. Temperature - Operating: -65 to 165°F
5. Pressure -
 - a. Operating: 1200 psi
 - b. Proof: 2400 psi
 - c. Burst: 5000 psi
 - d. Static setting: 810 ± 8 psi at $80^\circ \pm 20^\circ\text{F}$
 - e. Differential pressure actuation to deactuation:
 - (1) Minimum: 25 psi
 - (2) Maximum: 35 psi
 - f. Range: 200 to 1200 psia
6. Electrical Characteristics -
 - a. Electrical switch: Single-pole, double-throw, 3-amp resistance load at 28 vdc
 - b. Insulation resistance: 50 megohms minimum
 - c. Contact resistance: 0.5 ohms maximum



THRUST OK PRESSURE SWITCH, 20M50830 -
SECTIONAL VIEW

December 1965

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Page 9 of 18

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DATA SHEET	
Nomenclature: Switch (Thrust OK Pressure)	
Drawing Numbers: 60C27818	Vendor: Southwestern
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2500 cy.	
Failure Rate: 1520 x 10 ⁻⁶ /cy.	MCEF (in cycles): 657.8
Number of Components this Data Represents: 24	Total Cycles of Operation: 911
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

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Page 11 of 18

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-9 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Thrust OK Pressure Switch, Part No. 60C27818-1

Each thrust OK pressure switch initiates an actuation signal to cut off an engine when there is a significant pressure drop in the fuel discharge line.

1. Vendor - Southwestern Industries, Inc., Part No. PS-5807
2. Location - Station 94
3. Service - RP-1 fuel
4. Temperature - Operating: -65 to 165°F
5. Pressure -
 - a. Working: maximum 1000 psia
 - b. Proof: 2400 psi
 - c. Static setting: 810 ± 8 psi at $80^\circ \pm 20^\circ\text{F}$
 - d. Differential pressure actuation to deactuation:
 - (1) System Port: minimum 25 psi, maximum 40 psi
 - (2) Calibration Port: minimum 20 psi, maximum 40 psi
 - e. Range: 200 to 1000 psia
6. Electrical Characteristics -
 - a. Electrical switch: Single-pole, double-throw, 3-amp resistance load at 28 vdc
 - b. Insulation resistance: 50 megohms minimum
 - c. Contact resistance: 0.3 ohms maximum

Part No. 20M50830 is similar to this part. Reference page 5, II.17.8.

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DATA SHEET	
Nomenclature: Switch (Thrust OK Pressure)	
Drawing Numbers: 60C20278	Vendor: Southwestern Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2500 cy.	
Failure Rate: 2674 x 10 ⁻⁶ /cy.	MCEF (in cycles): 374
Number of Components this Data Represents: 18	Total Cycles of Operation: 374
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-8 and SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

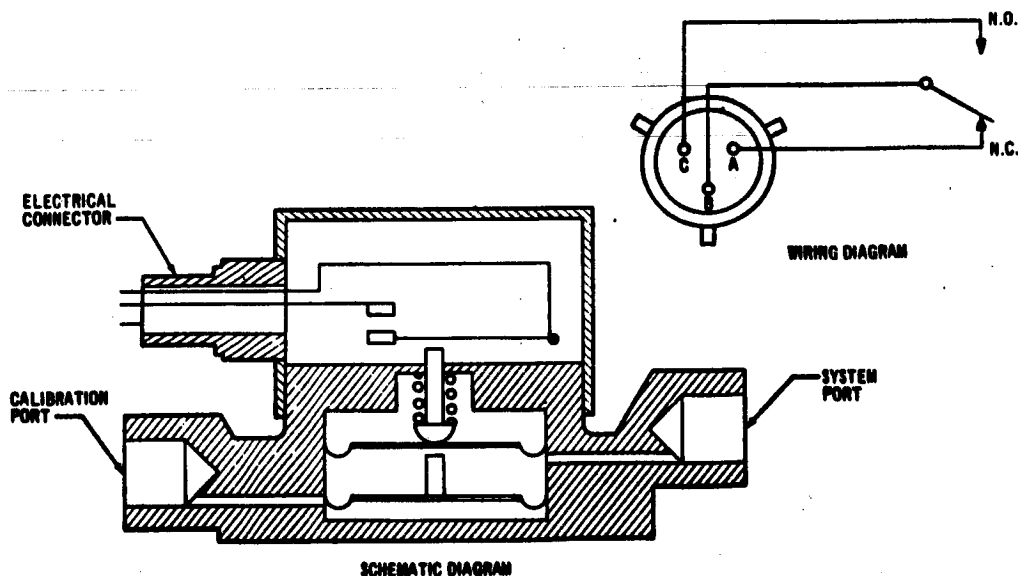
Additional information concerning the 60C20278 component:

One failure was reported on an Unsatisfactory Condition Report, five were reported on Inspection Reports.

Additional information concerning the 60C20278 component:

The thrust OK pressure switch initiates an actuation signal to cut off all engines when there is a significant pressure drop in the fuel discharge line.

1. Vendor - Southwestern Industries, Inc., Part No. PS-5807-810
2. Location - Station 94
3. Service - RP-1 fuel
4. Temperature - Operating: -65 to 165°F
5. Pressure -
 - a. Operating: 1000 psi
 - b. Proof: 1500 psia
 - c. Burst: 2850 psia
 - d. Static setting: 810 ± 8 psi at $70^\circ \pm 20^\circ\text{F}$
 - e. Differential pressure actuation to deactuation:
 - (1) Minimum: 25 psi
 - (2) Maximum: 40 psi
 - f. Range: 200 to 1000 psia
6. Electrical Characteristics -
 - a. Electrical switch: Single-pole, double-throw, 3-amp resistance load at 30 vdc
 - b. Insulation resistance: 50 megohms minimum
 - c. Contact resistance: 0.3 ohms maximum



**THRUST O.K. PRESSURE SWITCH, 60C20278 -
SECTIONAL VIEW**

SUMMARY SHEET	
Nomenclature Switch, Absolute Pressure	
Drawing Numbers: 10414086, 20M30415 Saturn I Vehicle	Vendor: Gianniani Controls, Southwestern Industries Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $33,333 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 18 Total Number of Failures Reported: 13	MCBF (in cycles): 30.0 Total Cycles of Operation: 390 Vehicle Equipment: X Ground Equipment:

December 1965

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Page 1 of 16

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>13</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Ruptured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
Low			
High			
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3, SA-4, SA-5 and SA-6 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Switch, Absolute Pressure	
Drawing Numbers: 10414086	Vendor: Giannini Controls
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 15,748 x 10 ⁻⁶ /cy.	MCBF (in cycles): 63.5
Number of Components this Data Represents: 6	Total Cycles of Operation: 88
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE
TITLE SATURN C-1 COMPONENTS ASSEMBLY PROCEDURE 10414086 ABSOLUTE PRESSURE SWITCH ASSEMBLY		2 July 1962
		PROCEDURE EP-140
		APPROVED
		1 of 4

1. DESCRIPTION.

The absolute pressure switch assembly 10414086 is a pressure operated switch that incorporates a multiple diaphragm pressure element that actuates a precision snap action switch at an adjustable absolute pressure. The switch assembly is a component of the instrument containers cooling system. The switch assembly controls the flow of GN₂ from the fuel tank pressurization high pressure sphere assemblies that pressurize the ST-90 stabilized platform compartment in instrument container 15. The switch assembly is located in instrument container 15 as shown in the installation view. The various functional characteristics of the pressure switch are as follows:

1.1 Mechanical Performance Characteristics. The pressure switch is capable of performing mechanically as follows:

- a. Operating media: Air or gaseous nitrogen.
- b. Operating temperature range: -65° to +165° F.
- c. Operating pressure requirement: 20 p.s.i.g. minimum without damage, leakage, or impairment of performance.
- d. Proof pressure: 30 p.s.i.g. minimum inlet pneumatic pressure.
- e. Burst pressure (without failure): 50 p.s.i.g. minimum inlet pneumatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- f. Actuation pressures: Increasing pressure - 14 p.s.i.a. maximum. Decreasing pressure - 12 p.s.i.a. minimum.

1.2 Electrical Performance Requirements. The pressure switch is capable of performing electrically as follows:

- a. Continuity resistance between electrical connector pins "A" and "C" on increasing pressure actuation or pins "B" and "C" on decreasing pressure actuation: 0.5 ohm maximum.
- b. Insulation resistance: 50 megohms minimum between each isolated electrical connector pin and the switch case with 500 v.d.c. applied.

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The pressure switch is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 20 g's in each of the three major axes.

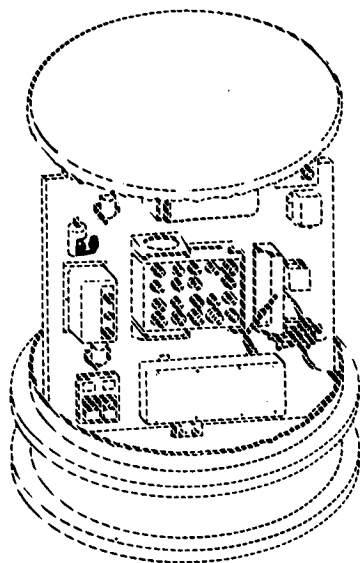
10-milliseconds duration - triangular wave, or
 8-milliseconds duration - sine wave, or
 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The pressure switch is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

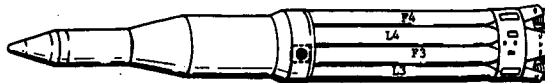
REVISION DATE

(Continued on page 4)

10414086



INSTALLATION VIEW - INSTRUMENT CONTAINER 15



GENERAL LOCATION

===== LEGEND =====

10414086 ABSOLUTE PRESSURE SWITCH ASSEMBLY
(ASSEMBLE USING THE ABSOLUTE
PRESSURE SWITCH 10414085, SOURCE:
GIANNINI CONTROLS CORP., 445238-6
A B C D E)

===== NOTES =====

- A OR APPROVED EQUIVALENT.
- B IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- C STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- D CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- E CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.

DRAWN BY:	<i>B. L. Dennis</i>	ENGINEERING DRAWING RELEASE A	REVISION TO:	10414086	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. L. Bennett</i>		EO'S		
WRITER:	<i>G. E. Schenk</i>		ART CON. N. NO.		
APPROVED BY:	<i>M. Lichtman</i>				

M-MS-EP140- 831

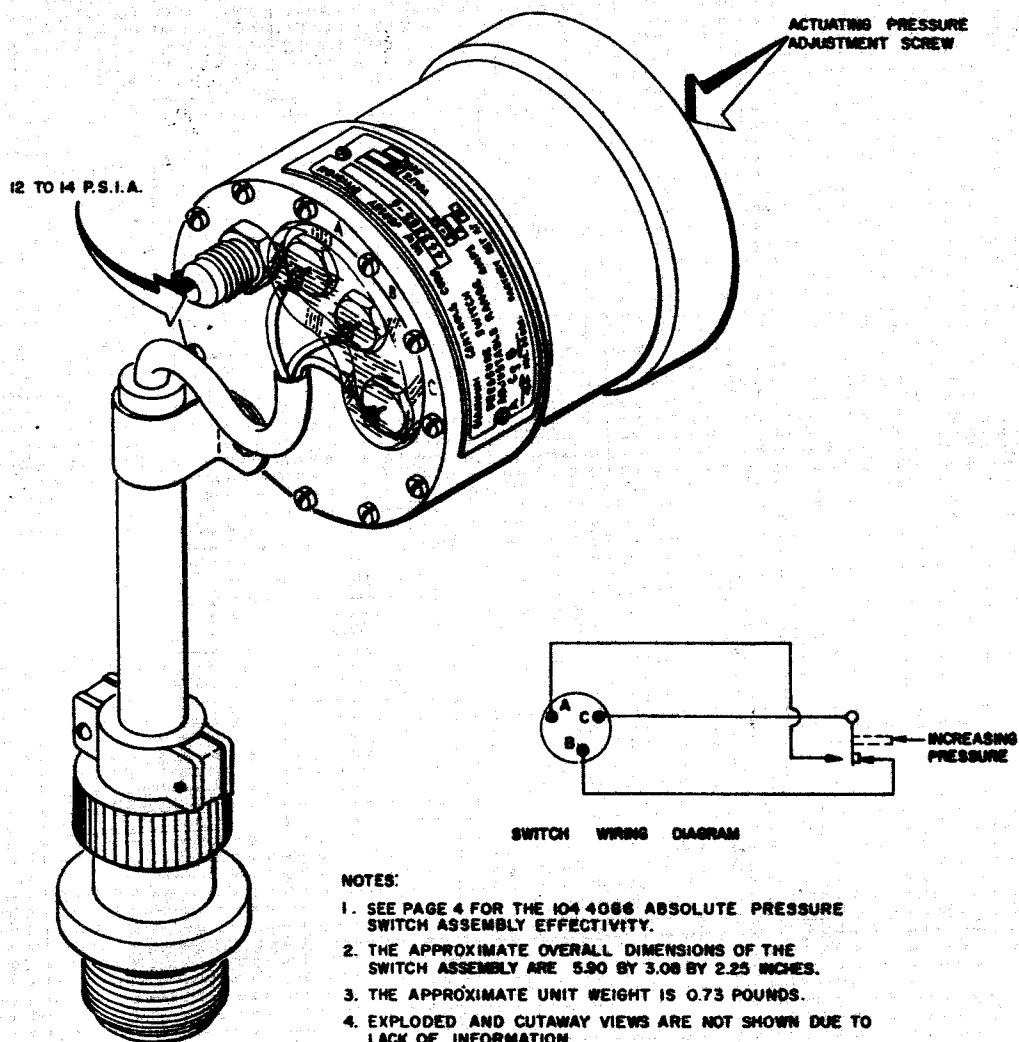
MANUFACTURING PLAN

PROCEDURE

EP-140

PAGE

3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 1044086 ABSOLUTE PRESSURE SWITCH ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE SWITCH ASSEMBLY ARE 5.90 BY 3.08 BY 2.25 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 0.73 POUNDS.
4. EXPLODED AND CUTAWAY VIEWS ARE NOT SHOWN DUE TO LACK OF INFORMATION.

REVISION DATE

M-MS-EP140-031

10414086

1.4 (con.)

20 to 45 c.p.s. at 1 g,
45 to 95 c.p.s. at 0.010-inch double amplitude displacement, and
95 to 2,000 c.p.s. at 5 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance test and the preparation for delivery of the pressure switch are outlined in Performance Specification 10419956 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33586

3.3 Drawings:

Ordnance Corps - 10419956
10509300
10509302
10509305
10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	Not Applicable
SA-1	"A" Rev.
SA-2	"A" Rev.
SA-3	"A" Rev.
SA-4	"A" Rev.
SPARES	Before installing modify to latest configuration

10414086

REVISION DATE

DATA SHEET	
Nomenclature: Switch, Absolute Pressure	
Drawing Numbers: 20M30415	Vendor: Southwestern Industries
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $43,103 \times 10^{-6}/\text{cy.}$	MCFP (in cycles): 23.2
Number of Components this Data Represents: 12	Total Cycles of Operation: 302*
Number of Failures Reported: 13	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

* Minimum operating cycles, serial Nos.
31225 not included in running cycle logs.

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>13</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish		Other: _____
	Out of Specs		_____
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 and SA-6 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M30415 component:

All thirteen failures were reported on Inspection Reports.

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MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 9 April 1963
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30415 INSTRUMENT UNIT ABSOLUTE PRESSURE SWITCH		PROCEDURE MPI-2000
APPROVED <i>[Signature]</i>		PAGE 1 of 4

1. DESCRIPTION

The instrument unit absolute pressure switch 20M30415 is a component of the inflight operation instrument unit cooling system. The pressure switch is used to indicate both increasing and decreasing pressures in the range indicated below. During flight when the pressure in the instrument compartment reaches approximately 17.0 p.s.i.a. due to boiloff of the compartment cooling IN₂, the switch signals the solenoid operated vent valve 20M30416 to open and relieve the excessive pressurization to the interstage area. From the interstage area the GN₂ cooling air bleedoff vents through four orifices to the atmosphere. When the pressure in the instrument compartment drops 0.4 or 0.6 p.s.i., depending upon environmental conditions, below the actual actuation pressure of the pressure switch - the switch signals the vent valve to close. The pressure switch is located in tube 5 of the 154-inch-diameter instrument unit assembly as shown in the installation view. The various functional characteristics of the pressure switch are as follows:

1.1 Mechanical Performance Characteristics. The pressure switch is capable of performing mechanically as follows:

- a. Operating temperature range: -65° to +165° F.
- b. Reference pressure settings under the conditions of standard temperature, no shock or vibration:
 - To actuate - 16.9 p.s.i.a. maximum (possess continuity between electrical connector pins "B" and "C")
 - To deactuate - 15.8 p.s.i.a. minimum (possess continuity between electrical connector pins "A" and "B")
 - Differential between actuation and deactuation pressures - 0.6 p.s.i. minimum.
- c. Pressure setting shift due to conditions of vibration and shock throughout the operating temperature range:
 - To actuate - 17.0 p.s.i.a. maximum
 - To deactuate - 15.7 p.s.i.a. minimum
 - Differential between actuation and deactuation pressures - 0.4 p.s.i. minimum.
- d. Proof operating pressure: 25 p.s.i.a. internal pneumatic pressure.
- e. Burst pressure (without rupture): 42 p.s.i.a. internal pneumatic pressure.
- f. Operating time: 5.0 milliseconds after the switch pressure has reached the preset actuation or deactuation pressure with a pressure change rate of 1.0 p.s.i. per minute.
- g. External leakage: None when the switch is pressurized pneumatically from 0 to 25 p.s.i.a.
- h. Vacuum withstanding capability: 0 to 0.5 p.s.i.a. vacuum atmosphere.
- j. Life cycle withstanding capability: 2,500 cycles of operation.
- k. Service media: Air or gaseous nitrogen.

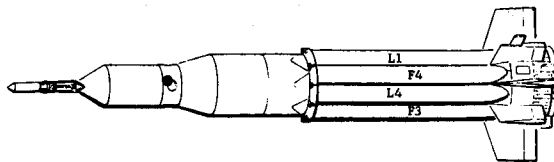
1.2 Electrical Performance Requirements. The electrical performance requirements of the switch are as follows:

- a. Operating voltage range: 22 to 28 v.d.c. with 28 v.d.c. nominal.
- b. Circuit resistance: 0.5 ohm maximum between the connector terminals when their respective circuits are closed.

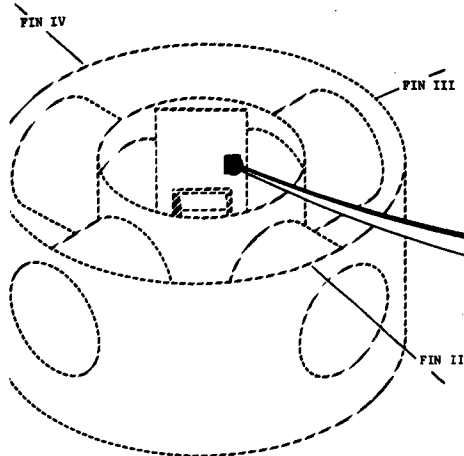
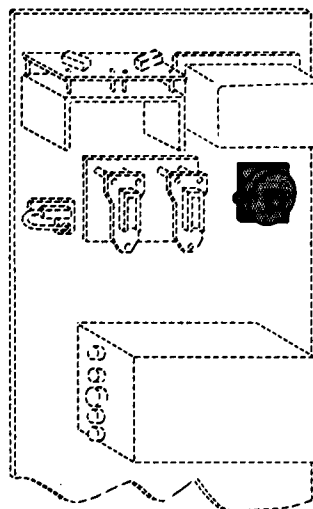
REVISION DATE

(Continued on page 4)

20M30415



GENERAL LOCATION

INSTALLATION VIEW - INSTRUMENT UNIT
ASSEMBLY 10M20000 (TUBE 5)

NOTES

- Ⓐ CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACE, EXCEPT ELECTRICAL COMPONENTS, IN ACCORDANCE WITH MSFC-SPEC-164.
- Ⓑ IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- Ⓒ OR APPROVED EQUIVALENT.
- Ⓓ CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- Ⓔ SOLDER IN ACCORDANCE WITH MSFC-PROC-158.

LEGEND

20M30415		INSTRUMENT UNIT ABSOLUTE PRESSURE SWITCH (EO-1) (SOUTHWESTERN INDUSTRIES INC., LOS ANGELES 54, CALIF., PART PS-5602-17A) Ⓐ Ⓑ Ⓒ Ⓓ
1.	APS-5602-17A	ABSOLUTE TOGGLE PRESSURE SWITCH ASSEMBLY
1.1	6757	NUT
1.2	6736	INLET FITTING
1.3	6760-3	DIAPHRAGM
1.4	6735	DIAPHRAGM PICK-UP
1.5	6792	DRIVER
1.6	6722	JACK SCREW
1.7	6723	STOP PLATE
1.8	6793	JAM NUT
1.9	6791	CENTER PIVOT
1.10	6761	BASE
1.11	6679	ADJUSTING NUT
1.12	6790	ADJUSTING SCREW
1.13	6724	LOCK NUT
1.14	6725	PIN
1.15	6666-4	FRAME
1.16	6645	PIVOT PIN
1.17	6644	TOGGLE PIVOT
1.18	6671	TOGGLE BLADE
1.19	6789	ROLLER (4 PLACES)
1.20	6748	BRACKET
1.21	6782	SCREW
1.22	6838	TWISTED CONTACT BLADE ASSEMBLY
1.23	6836	STATIONARY CONTACT ASSEMBLY
1.24	6777	SCREW
1.25	SW-1520-64	ELECTRICAL WIRING Ⓔ
1.26	SW-2510	RECEPTACLE
1.27	6813	CASE ASSEMBLY

DRAWN BY:

W.D. Smith

ENGINEERING
DRAWING
RELEASE

REVISION TO:

20M30415

REVISION
DATE OF
THIS PAGE

PLANNER:

F.W. Pharis

EO'S

-1

WRITER:

G. L. Schunk

APPROVED BY:

M. L. Schunk

ART CONTROL NO.

M-ME-E-1093

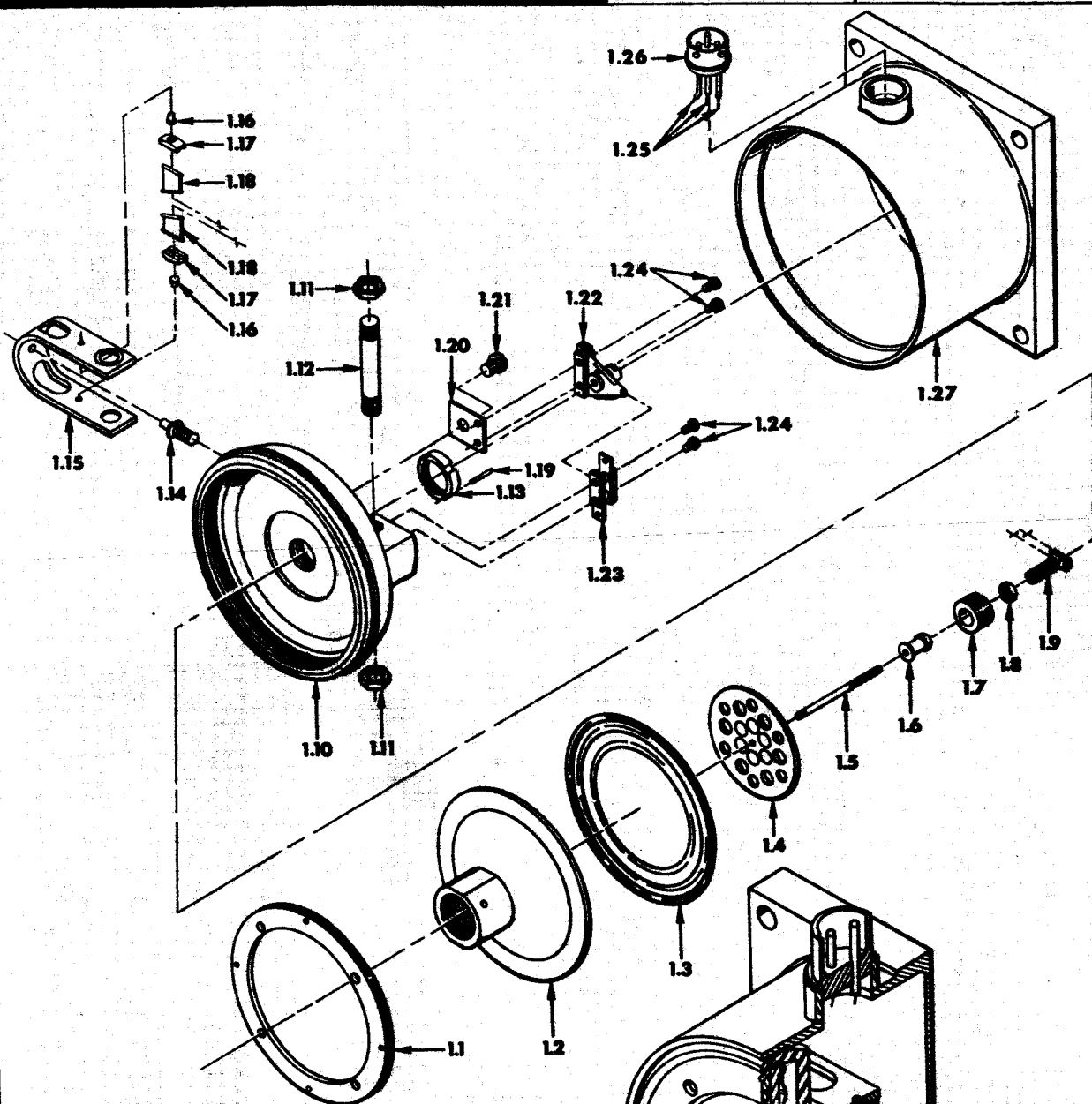
MANUFACTURING PLAN

PROCEDURE

MPI-2000

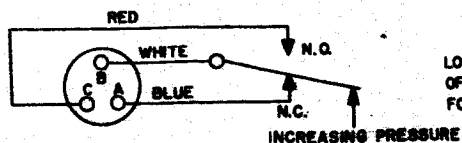
PAGE

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NOTES:

1. SEE PAGE 4 FOR THE 20M30415 INSTRUMENT UNIT ABSOLUTE PRESSURE SWITCH EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE PRESSURE SWITCH ARE 2.44 BY 3.03 BY 3.88 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 0.875 POUNDS.



WIRING DIAGRAM

LOCATED ON OTHER SIDE
OF FITTING, SHOWN HERE
FOR CLARITY

REVISION DATE

M-ME-E-1093

20M30415

1.2 (con.)

c. Insulation resistance: 50 megohms minimum with 500 v.d.c. applied between the electrical connector pins (circuit open) and between each connector pin and the switch body.

d. Indicating switch details: Single-pole, double throw with a 3 a. resistive load rating at 28 v.d.c. (CAUTION: The maximum resistive load applied to the switch during fabrication or testing must not be greater than 0.5 a.)

CAUTION: Paragraphs 1.3 and 1.4 constitute destructive test items that are performed only at the option of the procuring activity.

1.3 Shock Withstanding Capability. The pressure switch is designed to withstand, without damage or impairment of performance, three shocks in each direction along each of the three major axes of one of the following durations and wave forms at 35 g's while pressurized at 0.7 p.s.i. below normal actuation pressure:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - half sine wave, or
- 6-milliseconds duration - square wave.

1.4 Vibration Withstanding Capability. The pressure switch is designed to withstand - without actuation, damage, or impairment of performance - vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions while increasing pressurization from 0 p.s.i.g. to 0.5 p.s.i. below the nonvibration actuation pressure:

- 20 to 55 c.p.s. at 3.0 g's,
- 55 to 110 c.p.s. at 0.02-inch double amplitude displacement, and
- 110 to 2,000 c.p.s. at 10.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the pressure switch are outlined in Performance Specification 10M01613 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
 NASA - MSFC-SPEC-164
 MSFC-PROC-158

3.2 Standards:

Military - MIL-STD-130

3.3 Drawings:

Ordnance Corps - 10509302
 MSFC - 10M01613

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	EO-1
SA-6	EO-1
SA-7	EO-1
SA-8	EO-1
SA-9	EO-1
SA-10	EO-1
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30415

REVISION DATE

SUMMARY SHEET	
Nomenclature Accumulator Reservoir Assembly	
Drawing Numbers: 10415898, 20M85008 20M85062 Saturn I Vehicle	Vendor: Cadillac Gage Co. Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: $5,675 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 39 Total Number of Failures Reported: 0	MCBF (in cycles): 176.2 Total Cycles of Operation: 298.5 Vehicle Equipment: X Ground Equipment:

December 1965

II.18.1
Page 1 of 10

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-9 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Accumulator Reservoir Assy.	
Drawing Numbers: 10415898	Vendor: Cadillac Gage Co.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: $19,960 \times 10^{-6}/\text{cy.}$ Number of Components this Data Represents: 8 Number of Failures Reported: 0	MCHF (in cycles): 50.1 Total Cycles of Operation: 69.3 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 and SA-3 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Accumulator Reservoir Assy.	
Drawing Numbers: 20M85008	Vendor: Cadillac Gage Co.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: $47,169 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 21.2
Number of Components this Data Represents: 4	Total Cycles of Operation: 29.4
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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II.18.1
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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 Vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Accumulator Reservoir Assy.	
Drawing Numbers: 20M85062	Vendor: Cadillac Gage Co.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: 6,930 $\times 10^{-6}$ /cy.	MCBF (in cycles): 144.3
Number of Components this Data Represents: 27	Total Cycles of Operation: 199.8
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M85062 component:

The accumulator, reservoir, and manifold assembly consists of a high-pressure, double-wall, piston-type accumulator; a low-pressure, piston-type reservoir; and a manifold for external connections and measuring devices.

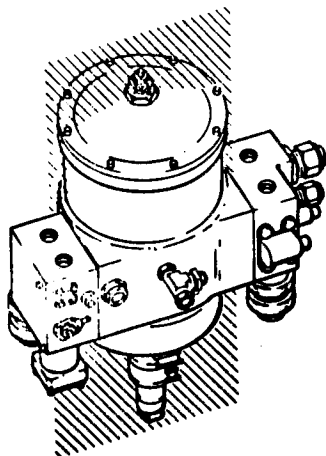
The high-pressure accumulator section receives fluid at 3200 psig. Pump discharge pulsations are dampened by the accumulator piston compressing the GN_2 . High-pressure fluid in the accumulator section serves as a source of high-pressure fluid for sudden actuator demands. The low-pressure reservoir stores fluid returned by the actuators and feeds the pump inlet.

The bootstrap piston has 1/60th the area of the reservoir piston. Therefore 3200 psig fluid acting on it causes the reservoir piston to pressurize the low-pressure fluid to 53.3 psig.

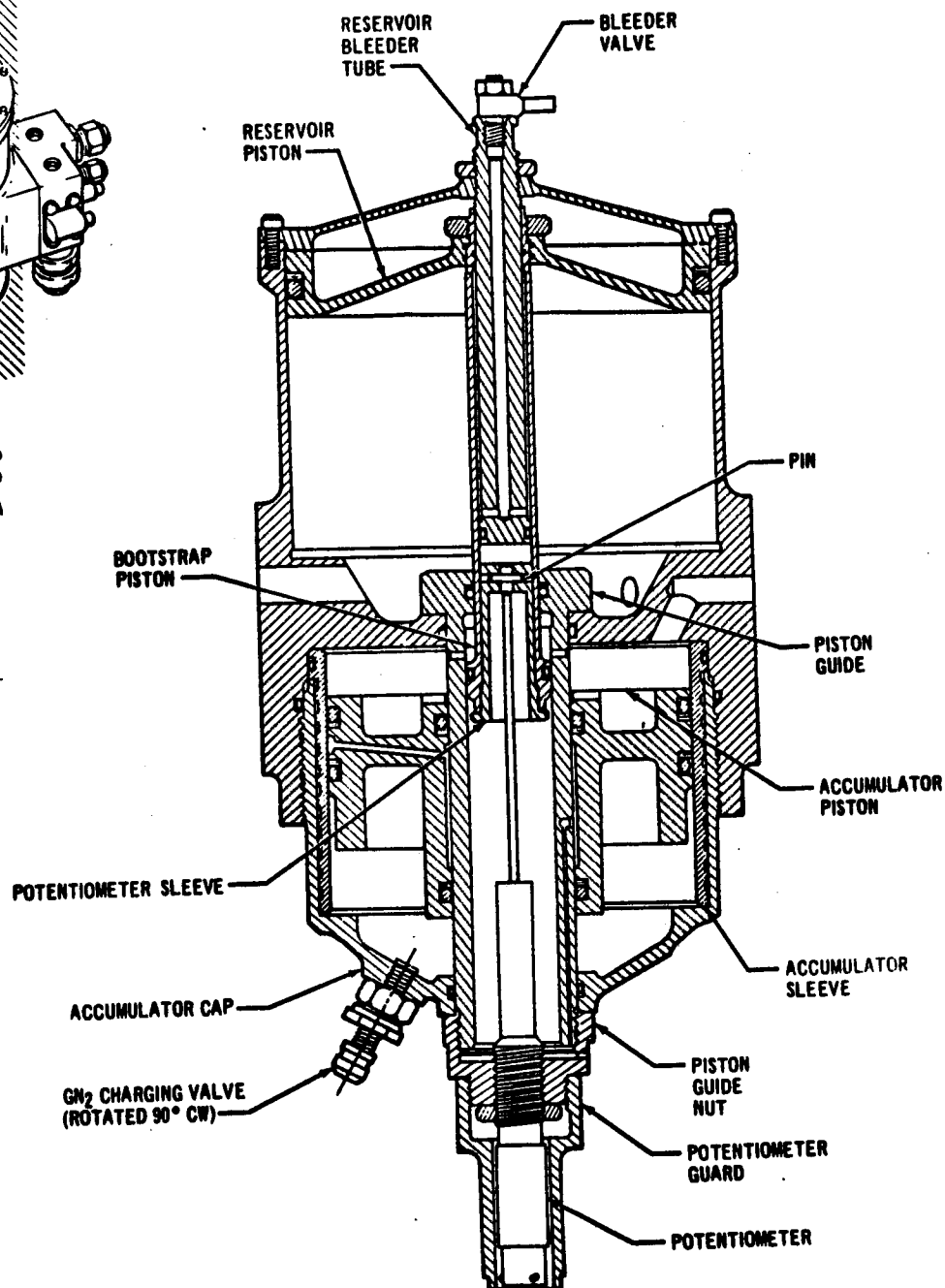
1. Vendor - Cadillac Gage Company, Part No. 20296
2. Location - Station 67
3. Service - Hydraulic fluid, MIL-H-5606, GN_2
4. Temperature - Operating: -65 to 275°F
5. Accumulator -
 - a. Pressure:
 - (1) Operating: 3200 psig
 - (2) Proof: 5000 psig
 - (3) Burst: 7500 psig
 - (4) Nitrogen pre-charge: 1500 psig
 - b. Total fluid volume: 38 cubic inches
 - c. Active fluid volume: 32 cubic inches
6. Reservoir -
 - a. Pressure:
 - (1) Operating: 53.3 psig
 - (2) Proof: 300 psig
 - (3) Burst: 600 psig
 - b. Oil volume (active): 104 cubic inches
 - c. Oil volume (total): 122 cubic inches
7. Leakage - No leakage allowed with bleed valves closed

December 1965 (Revision)

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A-A



SECTION A-A

ACCUMULATOR, RESERVOIR AND MANIFOLD ASSEMBLY,
20M85062 - SECTIONAL VIEW

II.1

DATA SHEET	
Nomenclature: Fuel Additive Blender Unit	
Drawing Numbers: 454075	Vendor: North American Aviation
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 500 cy.	
Failure Rate: 10,493 x 10 ⁻⁶ /cy.	MCEF (in cycles): 95.3
Number of Components this Data Represents: 43	Total Cycles of Operation: 572*
Number of Failures Reported: 6	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

* Minimum operating cycles. Serial Nos. R118V and 50 do not appear in time/cycle logs.

II.19.1
Page 1 of 5

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Burned Out		Indicator Shows:
	Erratic		No Open
	Foreign Material		No Close
	Frozen		Mechanical:
	Improper Seating		Binding:
	Intermittent		Broken/Cracked:
	Inoperative		Broken/Runtured:
<u>3</u>	Leaking		Defective: Spring, Toggle Arm, Gear Mesh
	Noisy		Bearing:
	Over Heated		Pins/Connections Shorted:
	Operation Sluggish	<u>1</u>	Other: _____
<u>1</u>	Out of Specs		<u>Broken insulation</u>
	Oil/Moisture Saturation		_____
	Sticking		_____
	Would Not Open		
	Would Not Close		
	Pressure:		
	None		
	Low		
	High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

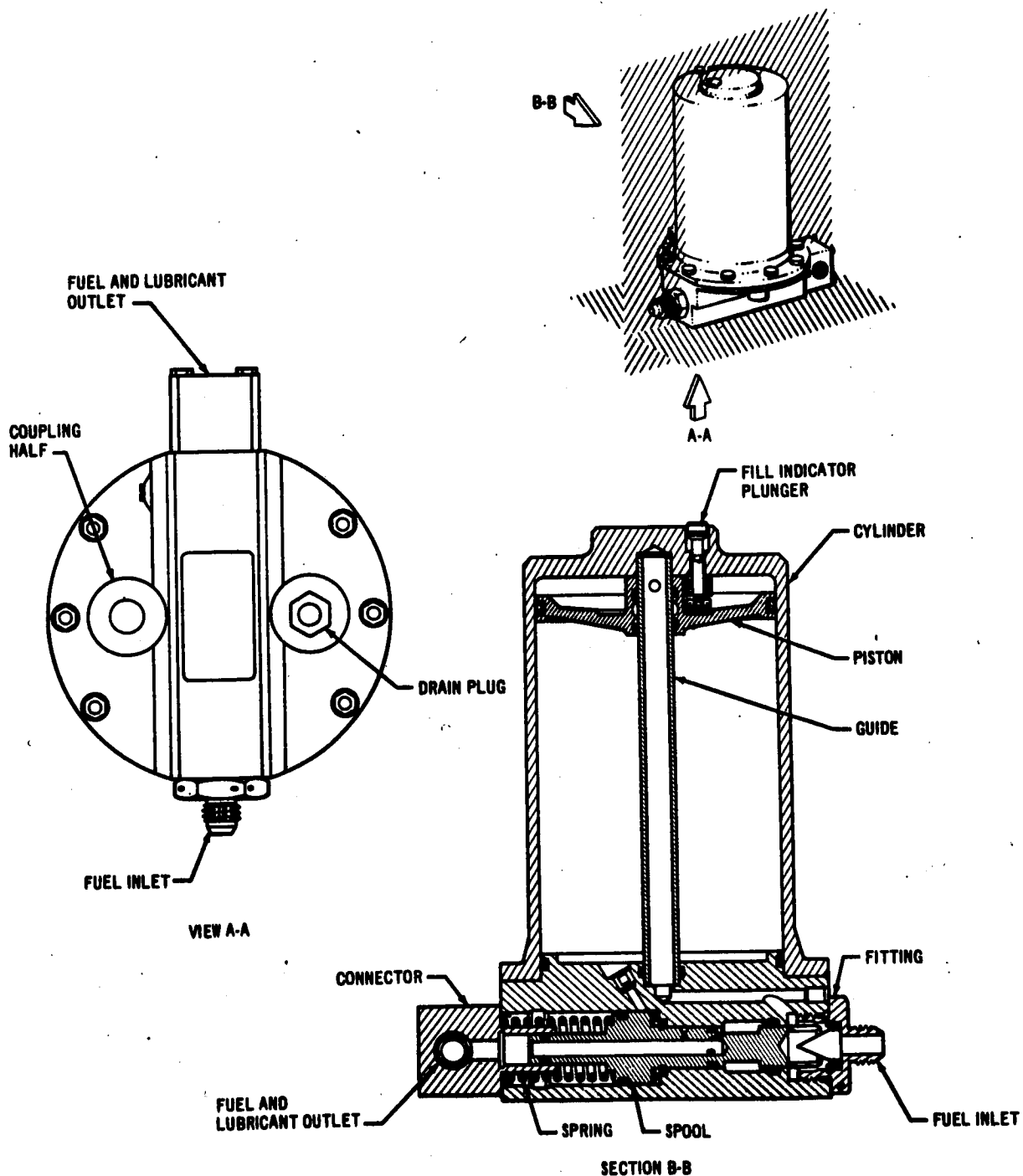
Additional information concerning the 454075 component:

The fuel additive blender unit (FABU) is a fuel-pressure operated lubricant blender that adds extreme pressure additive (oronite) to the fuel for lubrication and cooling of the turbo-pump gears and bearings.

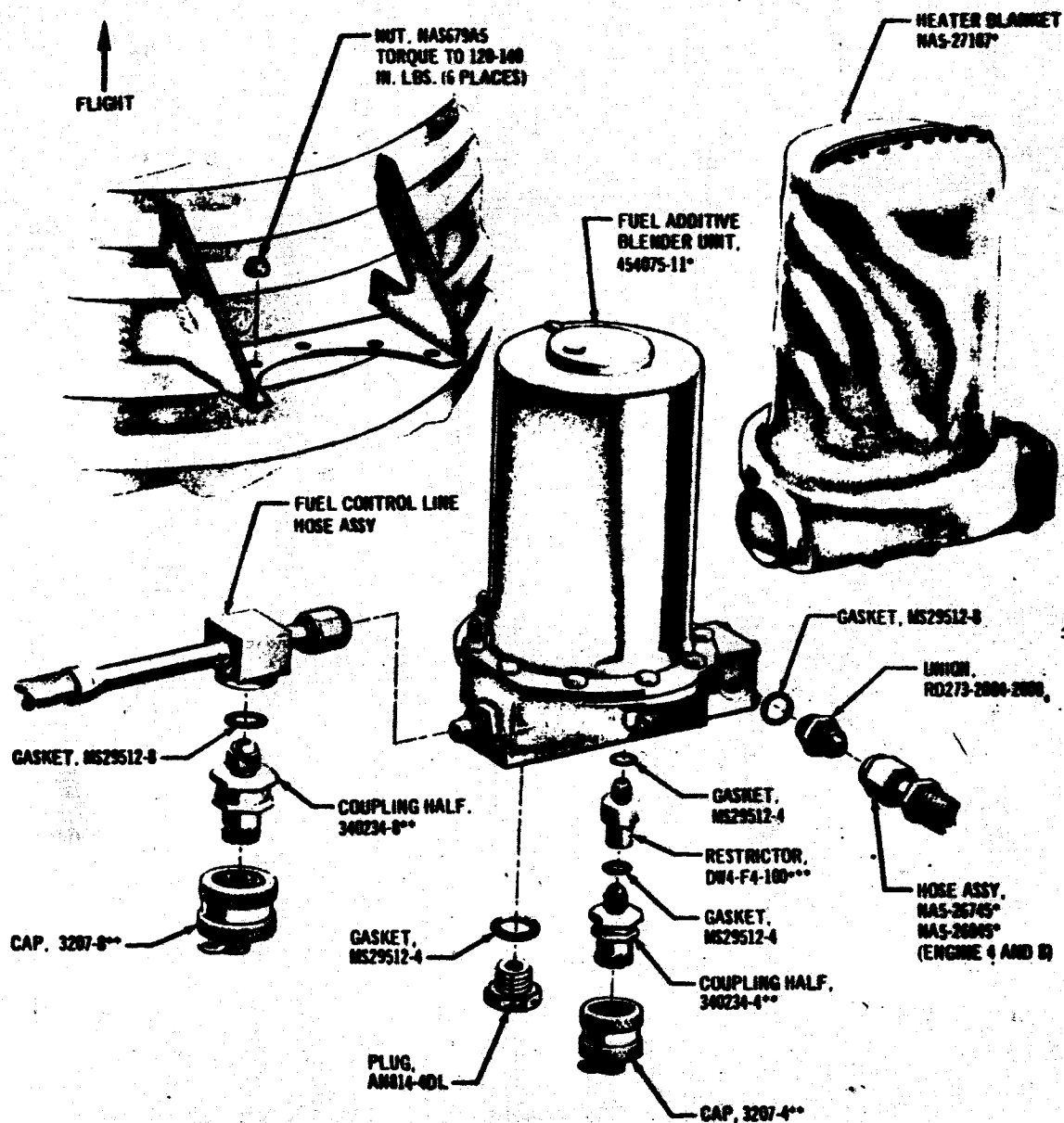
Installed on the FABU is a thermostatically controlled electric heater blanket to control temperature of the oronite.

1. Vendor - Rocketdyne Division, North American Aviation, Inc., Part No. 454075-11
2. Location - Station 73
3. Service - RP-1 fuel and Oronite 262
4. Heater Thermostat -
 - a. Opens: 127 to 143°F on increasing temperature
 - b. Closes: 135 to 145°F on decreasing temperature
 - c. Insulation resistance: 500-volt megger test each isolated terminal to blender body, 50 megohms minimum
5. Pressure -
 - a. Fuel:
 - (1) Cracking: 70 to 110 psig
 - (2) Reseat: 50 to 90 psig
 - b. Dry air: Cracking pressure, 250 to 320 psig
6. Flow Rate - 4.5 ± 0.5 gpm at 900 ± 20 psi
7. Additive Mixture - $3 \pm 0.5\%$ oronite
8. Lubrication - Lubricate packings and gaskets per RA0112-002 for RP-1 fuel service
9. Leakage - With 40 ± 2 psig applied to inlet port, no leakage is allowed except a momentary gas leakage at the vent seal

Five failures were reported on Inspection Reports. One failure was reported on an Unsatisfactory Condition Report.



**FUEL ADDITIVE BLENDER UNIT, 454075
SECTIONAL VIEW**



*NAA, ROCKETDYNE DIVISION
AEROSQUIP CORP.
***DEL MANUFACTURING CO.

FUEL ADDITIVE BLENDER UNIT, 454075 INSTALLATION VIEW

SUMMARY SHEET	
Nomenclature Motor (Hydraulic)	
Drawing Numbers: 10415248, 20M85006, 20M85065 Saturn I Vehicle	Vendor: Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: $5,310 \times 10^{-6}/\text{cy.}$ Total Number of Components this Data Represents: 45 Total Number of Failures Reported: 0	MCBF (in cycles): 188.3 Total Cycles of Operation: 260.8 Vehicle Equipment: X Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Motor (Hydraulic)	
Drawing Numbers: 10415248	Vendor:
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: 20,283 $\times 10^{-6}/\text{hr.}$	MTBF (in hours): 49.3
Number of Components this Data Represents: 8	Total Hours of Operation: 68.3
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

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Nomenclature:			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 and SA-3 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Motor (Hydraulic)	
Drawing Numbers: 20M85006	Vendor:
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: 55,248 $\times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 4 Number of Failures Reported: 0	MTBF (in hours): 18.1 Total Hours of Operation: 25.2 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

December 1965

Nomenclature:			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 Vehicle only (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Motor (Hydraulic)	
Drawing Numbers: 20M85065	Vendor: U.S. Electric Motors Incorporated
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: $5,977 \times 10^{-6}/\text{hr.}$	MTBF (in hours): 167.3
Number of Components this Data Represents: 33	Total Hours of Operation: 167.3
Number of Failures Reported: 1	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

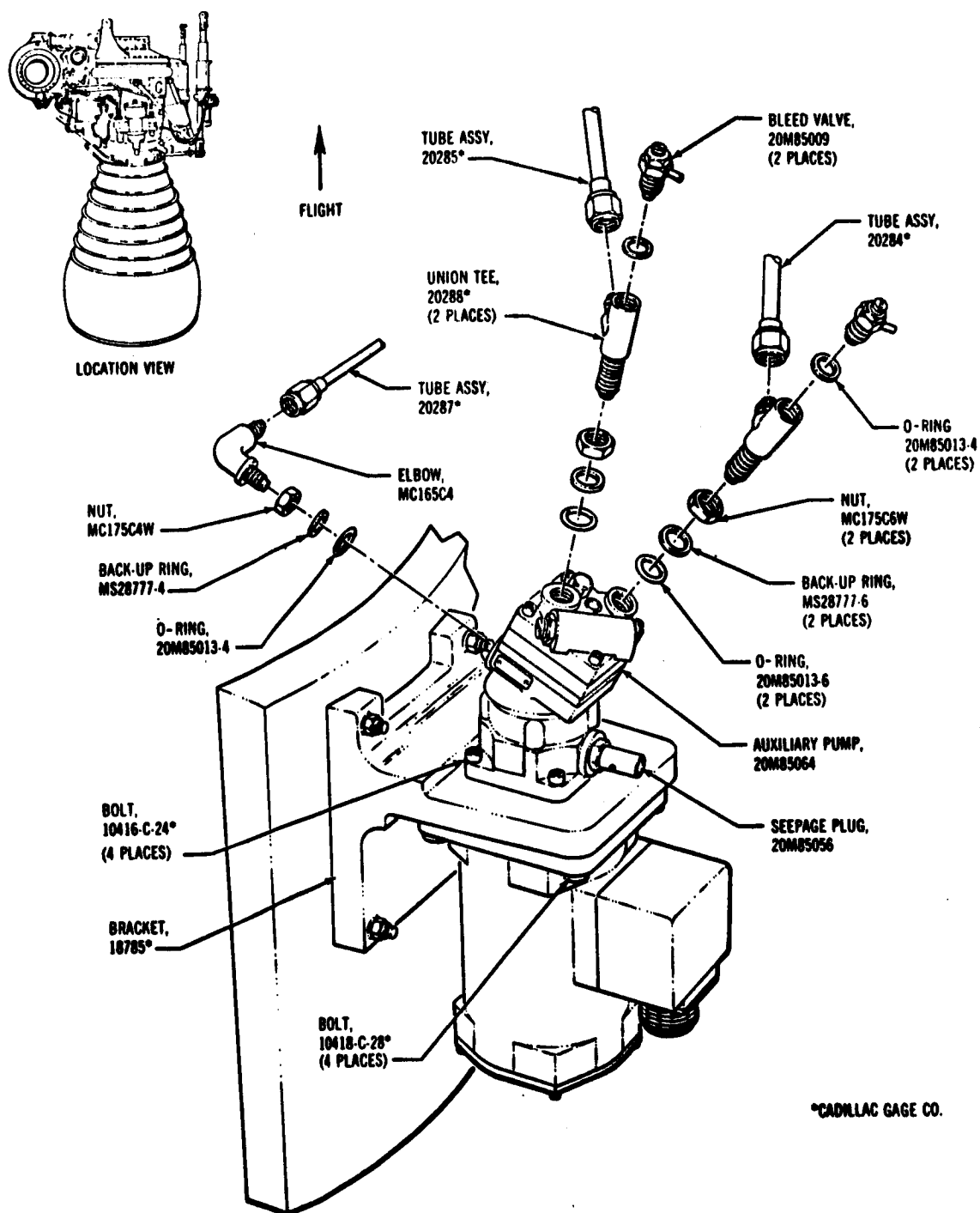
II,20,1
Page 7 of 10

Nomenclature:			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction	<u>1</u>	Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other: Unspecified
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the 20M85065 component:

The electric motor, an open type, fan cooled, aircraft unit, drives the auxiliary pump.

1. Vendor - U.S. Electric Motors Incorporated, Part No. 406930
2. Location - Station 67
3. Service - Hydraulic fluid, MIL-H-5606
4. Temperature - Operating: Ambient range: 0 to 165°F
5. Torque - 25 in. lbs minimum with motor at rest and full current and voltage applied
6. Electrical Characteristics - The following motor performance exists at 200 volts line to line, 3 phase, 400 cycles, sea level and 77°F:
 - a. Speed: 10,500 $\pm 5\%$ rpm at 33 in. lbs torque
 - b. Maximum continuous duty: 4.5 hp
 - c. Motor life: 100 hours



AUXILIARY PUMP, 20M85064, AND MOTOR ASSEMBLY, 20M85065 - INSTALLATION VIEW

SECTION III
MECHANICAL COMPONENTS

LIST OF COMPONENTS

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
III. Mechanical Components		
III.1	<u>Valve, Relief</u>	
III.1.1	LOX	10414000 10414054 20M30460
III.2	<u>Valve, Interconnecting</u>	
III.2.1	Interconnecting	10414318
III.3	<u>Valve, Safety</u>	
III.3.1	Safety	10414350
III.4	<u>Gimbal Assembly</u>	
III.4.1	Assembly	202119
III.5	<u>Pumps</u>	
III.5.1	Turbo	454105 458412 456405-21 456405-51 456405-11 456405-31
III.5.2	Auxiliary (Hydraulic)	10415082 20M85005 20M85064
III.6	<u>Ducts</u>	
III.6.1	Turbine Exhaust	20M00013 20M51243 20M50621

LIST OF COMPONENTS (Continued)

<u>Section</u>	<u>Nomenclature</u>	<u>MSFC and Associated Drawing Numbers</u>
III.7	<u>Turbines</u>	
III.7.1	Gas	454204 4510031

SUMMARY SHEET

Nomenclature Valve, LOX Relief

Drawing Numbers: 10414000,
10414054, 20M30460

Vendor: North American
Aviation Rocketdyne Div.,
Calmec Mfg. Co.

Saturn I Vehicle

Location: S-I Stage

Estimated Design Life: 2,000 cy.

Failure Rate: $7,662 \times 10^{-6}/\text{cy.}$

MCBF (in cycles): 130.5

Total Number of Components
this Data Represents: 53

Total Cycles of Operation:
8,878

Total Number of
Failures Reported: 68

Vehicle Equipment: X
Ground Equipment:

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>42</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish <u>18</u> Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High	<u>6</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: 1 Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Log, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 Vehicles (less flight data)			

DATA SHEET	
Nomenclature: Valve, LOX Relief	
Drawing Numbers: 10414000	Vendor: Rocketdyne
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 7,880 x 10 ⁻⁶ /cy.	MCHF (in cycles): 126.9
Number of Components this Data Represents: 20	Total Cycles of Operation: 3,046*
Number of Failures Reported: 24	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature: <u>-250°F ± 25°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20-55 cps at 5 g, 55-110 cps at 0.03 in.</u> <u>D.A.d., 110-2,000 cps at 20 g with 55 psig</u> <u>on housing</u>	

December 1965

* Minimum operating cycles; logs do not include serial Nos. 27.0, 10.0 and 25.

III.1.1
Page 3 of 24

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>15</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish	<u>1</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>7</u>	Out of Specs Oil/Moisture Saturation		
<u>1</u>	Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: IN-P&VE-E-62-5, January 21, 1962, MSFC			

Additional information concerning the 10414000 LOX Relief Valve component:

Twenty-three failures were reported on Inspection Reports and one on Unsatisfactory Condition Reports.

MANUFACTURING PLAN

TITLE

SATURN COMPONENTS ASSEMBLY PROCEDURE
10414000 LOX RELIEF VALVE ASSEMBLY

DATE

17 April 1961

PROCEDURE

EP-140

APPROVED

R. Faust

PAGE

1 of 4

1. DESCRIPTION.

The LOX relief valve assembly 10414000 is a normally closed, spring loaded, poppet type valve. The valve is opened when the valve and orifice assembly 10414310 is signalled to pressurize the control chamber or when a predetermined flow chamber pressure is reached. The valve is used to maintain LOX container pressure during flight and to relieve the container pressure during the filling operation. The valve assembly is installed on containers L1 and L2 in the 4-inch vent assembly as shown in the installation view. The various functional characteristics of the LOX relief valve are as follows:

1.1 Flow Chamber Characteristics. When the LOX container is pressurized to 57 plus 4 minus zero p.s.i.g., the valve poppet opens permitting an upstream flow of 700 c.i.m. The valve closes at a minimum pressure of 51 p.s.i.g. The flow chamber is capable of performing as follows:

- a. Operating temperature range: -250° to $+250^{\circ}$ F.
- b. Nominal operating pressure: 61 p.s.i.g. minimum internal pneumatic pressure.
- c. Proof operating pressure: 90 p.s.i.g. minimum internal pneumatic pressure.
- d. Burst pressure (without rupture): 150 p.s.i.g. minimum internal pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Poppet reseating leakage upstream past the main lipseal: 120 c.i.m. maximum at 51 p.s.i.g. minimum flow chamber pressure.
- f. Service media: Air, GN_2 , or GOX conforming to Specification MIL-O-25508.
- g. External leakage with 51 plus 4 minus zero p.s.i.g. excluding flow past poppet seal: None allowed.

1.2 Pneumatic Override Characteristics. The pneumatic override feature is ground controlled to open the valve poppet thus relieving the LOX container pressure during the filling operation. Simultaneously the switch is closed signaling to the blockhouse that the valve is open. The pneumatic override feature is capable of performing as follows:

- a. Minimum operating pressure: 600 p.s.i.g. internal pneumatic pressure with the temperature stabilized at -250° plus 20° minus 0° F.
- b. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- c. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure.
- d. Burst pressure (without rupture): 1,875 p.s.i.g. minimum internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- e. Operating temperature range: -250° to $+250^{\circ}$ F.

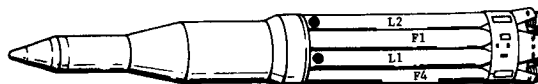
REVISION DATE

27 APR 1962

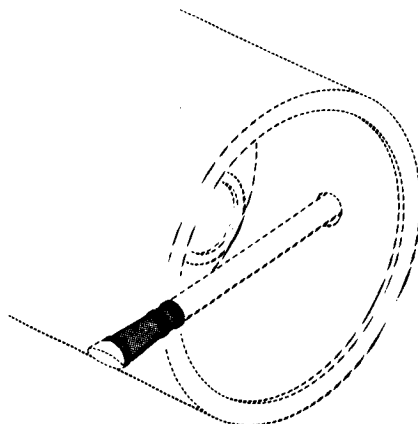
(Continued on page 4)

10414000

MSFC - Form 1151 (June 1961)



GENERAL LOCATION

INSTALLATION VIEW - LOOKING APT
(TYPICAL ON CONTAINERS L1 & L2)

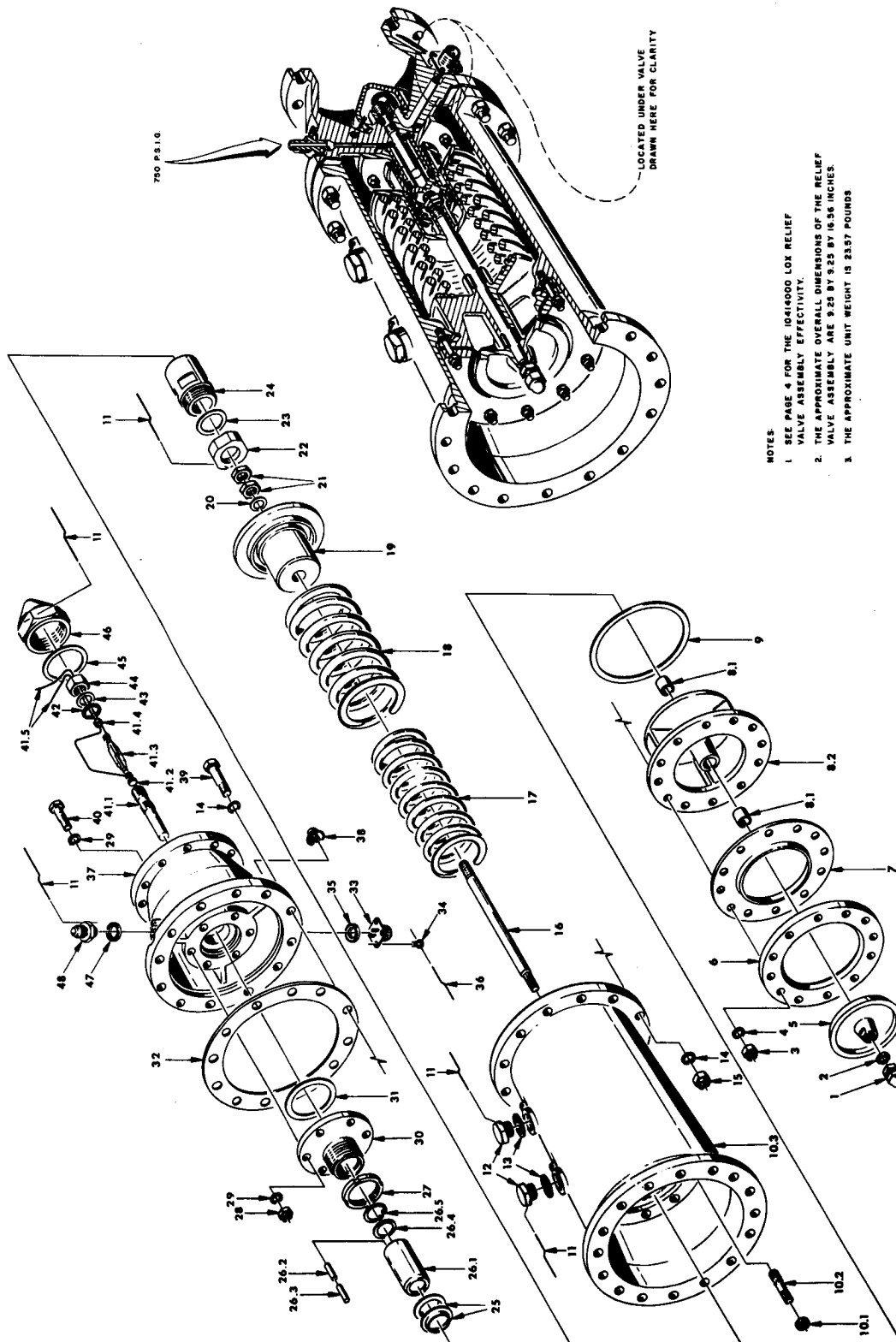
LEGEND

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPC-106.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) STAMP THE CURE DATE OF OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (E) TORQUE 100 TO 110 INCH-POUNDS.
- (F) OR APPROVED EQUIVALENT.
- (G) TORQUE 50 TO 70 INCH-POUNDS.
- (H) COOL BUSHING IN LIQUID NITROGEN OR EQUIVALENT AND HEAT RETAINER TO 300-350° F. INSERT BUSHING INTO RETAINER.
- (J) SEAL ON BOTH SIDES WITH KEL-F-10-200 SEALING WAX OR APPROVED EQUIVALENT.
- (K) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (L) TORQUE 400 TO 450 INCH-POUNDS.
- (M) TORQUE 100 TO 140 INCH-POUNDS.
- (N) LUBRICATE WITH DRY MOLYKOTE, TYPE 2, POWDER OR APPROVED EQUIVALENT. BLOW OFF EXCESS LUBRICANT WITH DRY NITROGEN GAS.
- (P) TORQUE 270 TO 300 INCH-POUNDS.
- (Q) TORQUE 250 TO 300 INCH-POUNDS.

- (R) IF THE MAGNETIC SWITCH DOES NOT ACTUATE PROPERLY, REMOVE THE FOUR PISTON SPACERS AND FOUR BAR MAGNETS FROM THE PISTON AND CUT OFF APPROXIMATELY 0.100-INCH FROM THE SPACERS. INSERT THE CUT OFF PORTION OF THE SPACERS, THE MAGNETS, AND FINALLY THE REMAINDER OF THE SPACERS. THE AMOUNT TO BE CUT OFF AND INSERTED BEFORE THE MAGNETS MAY VARY DUE TO MAGNET CHARACTERISTICS.
- (S) INSTALL WITH LIKE POLES NEAR THE DRILLED SURFACE OF THE PISTON.
- (T) TORQUE 150 TO 200 INCH-POUNDS.
- (U) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER FLANGE CONTACTS THE REAR HOUSING.
- (V) ADJUST TO INDICATE THAT THE VALVE IS CLOSED WHEN THE POPPET IS WITHIN 0.100-INCH MAXIMUM AND 0.010-INCH MINIMUM OF SEATING.
- (W) SOLDER BOTH ENDS OF SWITCH IN ACCORDANCE WITH SPECIFICATION DRAWING 10509300.
- (X) TORQUE 350 TO 400 INCH-POUNDS.
- (Y) TORQUE TO 1,200 INCH-POUNDS.
- (Z) TORQUE 180 TO 200 INCH-POUNDS.

- 10414000 LOX RELIEF VALVE ASSEMBLY ("B" REV., EO-6, -7 & -8) (A) (B) (C) (D)
1. 8941725 ACORN NUT (E)
2. 8060717 SEAL ("B" REV.) (PRECISION RUBBER PRODUCTS CORP. 110-3/8) (F)
3. AN363C428 SELF LOCKING NUT (12 PLACES) (G)
4. AN960C416 WASHER (12 PLACES)
5. 10414206 POPPET
6. 10414205 LIPSEAL RETAINER
7. 10414208 LIPSEAL (EO-1)
8. 10414211 LOX RELIEF VALVE RETAINER ASSEMBLY
- 8.1 9966442 RETAINER BUSHING ("A" REV.) (H)
- 8.2 10414213 RETAINER (H)
9. 8059517 RETAINER GASKET (FLEXITALLIC GASKET CO. R4-4K) (F) (J)
10. 10414268 LOX RELIEF VALVE HOUSING ASSEMBLY
- 10.1 8046883 LOCK RING (ROSAN INC. RL245B-7)
- 10.2 10414219 STUD (ROSAN INC. SF101-9SA-19A) (F)
- 10.3 10414262 FRONT HOUSING
11. MS20995C41 LOCKWIRE (K)
12. AN814-8DL SCREW THREAD PLUG AND BLEEDER (L)
13. 20M00420-8 K-SEAL (HARRISON MANUFACTURING CO., BURBANK, CALIF. 12100R8) (E)
14. AN960C516 WASHER (12 PLACES)
15. AN363C524 NUT (12 PLACES) (M)
16. 8944208 SHAFT ("B" REV.) (N)
17. 10414234 INNER SPRING
18. 8059248 OUTER SPRING
19. 8059668 RETAINER ("A" REV.)
20. AN960C716L WASHER
21. MS35691-730 JAM NUT (P)
22. 10414209 SEAL RETAINER ("A" REV.) (Q)
23. 10414233 SEAL
24. 10414204 PISTON RETAINER
25. 8945343 PISTON LIPSEAL (EO-1)
26. 10414203 PISTON ASSEMBLY ("A" REV.) (R)
- 26.1 10414221 PISTON ("B" REV.) (N)
- 26.2 10414224 BAR MAGNET (REVERE CORP. OF AMERICA, WALLINGFORD, CONN. E-6972-3) (S)
- 26.3 10414272 PISTON SPACER (4 PLACES)
- 26.4 10414223 PISTON WASHER
- 26.5 10414269 RETAINING RING (WALDES KOHINOOR INC., LONG ISLAND CITY 1, N.Y. 5001-100-C-MF) (F)
27. 8094178 RING (T)
28. AN363C428 SELF LOCKING NUT (6 PLACES) (G)
29. AN960C416 WASHER (6 PLACES)
30. 10414210 CYLINDER COVER
31. 8059512 COVER GASKET (FLEXITALLIC GASKET CO., CAMDEN, N.J. R4-3F) (P) (J)
32. 10414261 GASKET
33. 8944216 CONNECTOR ("A" REV.) (CANNON ELECTRIC CO., LOS ANGELES, CALIF. GS02-10SL-4P-111) (E)
34. MS35276-13 SCREW (4 PLACES)
35. 20M00420-8 K-SEAL (HARRISON MANUFACTURING CO. 12100R8) (F)
36. MS20995C20 LOCKWIRE (K)
37. 10414266 REAR HOUSING ASSEMBLY ("A" REV. & EO-2A)
38. 10414267 VENT SEAL (U)
39. AN5C14A BOLT (12 PLACES)
40. AN6C10A BOLT (6 PLACES)
41. 10414202 SWITCH ASSEMBLY ("B" REV., EO-4A, 6-5) (V)
- 41.1 10414201 SWITCH HOLDER ("A" REV.)
- 41.2 10414216 SWITCH BUSHING
- 41.3 10414215 SWITCH (EO-2) (REVERE CORP. OF AMERICA, GLASWICH E5600-23 or -33) (F)
- 41.4 10414598 SWITCH BUSHING
- 41.5 ELECTRICAL WIRING (MIL-W-16878, TYPE E, NICKEL PLATED AWG NO. 20) (H)
42. AN6227-9 PREFORMED PACKING (O-RING) (F) (N)
43. 10414237 BACKUP WASHER
44. 10414207 SWITCH NUT (X)
45. 10414226 SEAL
46. 10414214 CAP (Y)
47. 20M00420-4 K-SEAL (HARRISON MANUFACTURING CO. 12100R4) (F)
48. 10414255 MODIFIED UNION ("A" REV.) (Z)

DRAWN BY:	<i>J. Bolts</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414000	REVISION DATE OF THIS PAGE
PLANNER:	<i>Wm. E. Bennett</i>	B	EO'S	-6, -7, and -8	27 Apr 1962
WRITER:	<i>A. L. Schunk</i>		ART CONTROL NO.	M-MS-EP140-418-H	
APPROVED BY:	<i>W. H. L. L. L. L.</i>				



- NOTES:
1. SEE PAGE 4 FOR THE 10414000 LOX RELIEF VALVE ASSEMBLY EFFECTIVITY.
 2. THE APPROXIMATE OVERALL DIMENSIONS OF THE RELIEF VALVE ASSEMBLY ARE 9.25 BY 9.25 BY 16.56 INCHES.
 3. THE APPROXIMATE UNIT WEIGHT IS 23.57 POUNDS.

W-10414000-4188 10414000

REVISION DATE 27 APR 1962
 MSFC - Form 1351-2 (Rev 10-61)

1.2 (Con.)

- f. Leakage past control cylinder: 75 c.i.m. maximum of helium at 750 \pm 10 p.s.i.g. as measured on the upstream side of the control piston assembly.
- g. Poppet travel: 1.100-inches minimum when operated by the control piston assembly.
- h. Clearance between shaft and piston assembly: 0.010 to 0.030-inch.
- i. Service media: Air, GN_2 , or helium.
- j. Life cycle: 2,000 cycles without damage or impairment of performance.
- k. Poppet closing time with the temperature stabilized at -250° F. plus 20° F. minus 0° F.: 2 seconds maximum to fully closed position as indicated by the position switch.

- 1.3 Electrical Performance Characteristics. The magnetic position switch indicates that the valve is closed when the poppet is within 0.100-inch maximum to 0.010-inch minimum of the seal. A continuity check between pins "A" and "B" on the connector with the valve in the closed position must indicate less than 0.5 ohm resistance. With the valve in the open position the insulation resistance between pin "A" and valve body, pin "B" and the valve body, and pins "A" and "B" must be a minimum of 50 megohms. The switch operates from a 22 to 32 v.d.c. system with 28 v.d.c. nominal.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
8-milliseconds duration - sine wave, or
6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at three g's,
55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10419902 and Packaging and Packing Specification 10509302.

3. REFERENCES

3.1 Specifications:

Federal - QQ-S-571C/SN-60
 NASA - MSFC-SPEC-106
 Military - MIL-E-5272
 MIL-L-25567
 MIL-W-16878

3.2 Standards:

Military - MIL-STD-130
 MS33540
 Army Ballistic Missile
 Agency - ABMA-STD-18
 NASA - MSFC-STD-100

3.3 Drawings:

Ordnance Corps - 10419902
 10419909
 10509300
 10509302
 10509305
 10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"B" Rev., EO-6, -7, and -8
SA-1	"B" Rev., EO-6, -7, and -8
SA-2	"B" Rev., EO-6, -7, and -8
SA-3	"B" Rev., EO-6, -7, and -8
SA-4	"B" Rev., EO-6, -7, and -8
SPARES	Before installing modify to latest configuration

10414000

REVISION DATE 27 APR 1962

DATA SHEET	
Nomenclature: Valve, LOX Relief	
Drawing Numbers: 10414054	Vendor: North American Aviation
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $10,905 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 91.7
Number of Components this Data Represents: 10	Total Cycles of Operation: 127
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: (Same as on page 3, III.1.1)	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-3 and SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		DATE 24 January 1962
PROCEDURE EP-140		PAGE 1 of 4
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414054 750 P.S.I.G. PRESSURE RELIEF VALVE ASSEMBLY		APPROVED <i>R. Ruff</i>

1. DESCRIPTION.

The pressure relief valve assembly 10414054 is a component of the control pressure system. The relief valve is used to insure against overpressurization in the GN₂ control pressure system. The pressure relief valve assembly is a component of the pneumatic pressure control manifold assembly 10413666. The pressure relief valve assembly is installed in the rear skirt of container F2 as shown in the installation view. The various functional characteristics of the pressure relief valve assembly are as follows:

1.1 Operating Characteristics. The pressure relief valve assembly is capable of performing as follows:

- a. Operating temperature range: Minus 65° to plus 160°F.
- b. Operating media: Air, helium, or gaseous nitrogen.
- c. Leakage: 2 s.c.i.m. maximum through the six main vent holes with 750 ± 15 p.s.i.g. internal pneumatic pressure applied throughout the operating temperature range.
- d. Nominal operating pressure: 750 p.s.i.g.
- e. Proof operating pressure: 1,125 p.s.i.g.
- f. Burst pressure (without bursting): 1,875 p.s.i.g. (CAUTION: Use only for destructive acceptance testing.)
- g. Relief pressure: 950 ± 20 p.s.i.g. internal pneumatic pressure. Under the environmental conditions of temperature and shock the venting and relieving pressure is within 950 ± 50 p.s.i.g.
- h. Reseat pressure: 845 p.s.i.g.

CAUTION: Paragraphs 1.2 and 1.3 constitute destructive test items that are performed only at the option of the procuring activity.

1.2 Shock Withstanding Capability. The pressure relief valve assembly is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

- 10-milliseconds duration - triangular wave, or
- 8-milliseconds duration - sine wave, or
- 6-milliseconds duration - square wave.

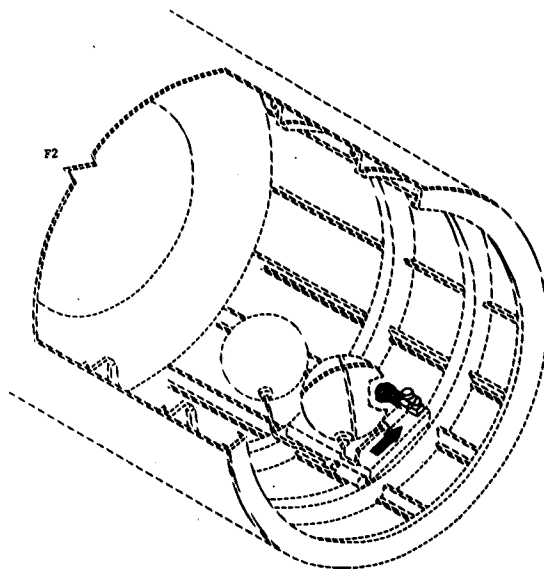
1.3 Vibration Withstanding Capability. The pressure relief valve assembly is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

- 20 to 55 c.p.s. at 3.0 g's
- 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
- 100 to 2,000 c.p.s. at 10.0 g's

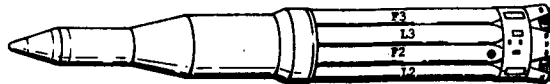
REVISION DATE
27 APR 1962

(Continued on page 4)

10414054



INSTALLATION VIEW - LOOKING FORWARD
(ARROW INDICATES FLOW DIRECTION)



GENERAL LOCATION

LEGEND

10414054	750 P.S.I.G. PRESSURE RELIEF VALVE ASSEMBLY ("B" REV) (NORTH AMERICAN AVIATION, INC. NO. 550435) A B C D E
1. 550442	ADJUSTING SCREW F
2. 9627-59971	NUT G
3. M820995C41	LOCKWIRE H
4. 550438	CLOSURE PLUG J
5. 550359	SPRING
6. 550353	ADJUSTING ROD K
7. 550362	SEAT ASSEMBLY L
7.1 550444	INSERT (E.I. DUPONT DE NEMOURS AND CO. INC. WILLINGTOWN, DELAWARE NYLON ROD, ZYTEL 101 COML.)
7.2 550355	SCREW M
7.3 550357	SOFT SEAT (E.I. DUPONT DE NEMOURS AND CO. INC. WILLINGTOWN, DELAWARE NYLON ROD, ZYTEL 101 COML.) N
7.4 AN6227-2	PREFORMED PACKING (O-RING) O K
7.5 550358	POPPET P
7.6 550361	POPPET SPRING
7.7 550354	PILOT VALVE BODY
8. AN6227-6	PREFORMED PACKING (O-RING) S K
9. 550436	SEAL BLOCK
10. AN6227-21	PREFORMED PACKING (O-RING) T K
11. 552550	SPRING
12. 9512-45154	PISTON U
13. AN6227-19	PREFORMED PACKING (O-RING) V K
14. 9512-45156	GASKET
15. 550437	NUT W
16. 550861	HOUSING
17. 550275	NAME PLATE

NOTES

- A CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509303.
- B IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- C STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- D CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- E OR APPROVED EQUIVALENT.
- F ADJUST TORQUE 20 TO 25 INCH-POUNDS.
- G TORQUE 20 TO 25 INCH-POUNDS.
- H LOCKWIRE IN ACCORDANCE WITH MS33560.
- J TORQUE 600 TO 900 INCH-POUNDS.
- K LUBRICATE WITH DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.
- L FUNCTIONAL CHECK BY APPLYING 750 ± 15 P.S.I.G. GASEOUS NITROGEN PRESSURE THROUGH THE FOUR (4) 1/16 DIAMETER HOLES AND THE .026 DIAMETER HOLE IN THE 550354 BODY. LEAKAGE SHALL NOT EXCEED 2 S.C.I.M.
- M TORQUE 25 TO 30 INCH-POUNDS.
- N TORQUE 450 TO 500 INCH-POUNDS.

DRAWN BY:	<i>R.A. Zortner</i>	ENGINEERING DRAWING RELEASE	REVISION TO:	10414054	REVISION DATE OF THIS PAGE
PLANNER:	<i>W.B. Bennett</i>	B	EO'S		
WRITER:	<i>L.F. Allen</i>				
APPROVED BY:	<i>W. H. Hightower</i>		ART CONTROL NO.	M-MS-EP-140-021	

MANUFACTURING PLAN

PROCEDURE

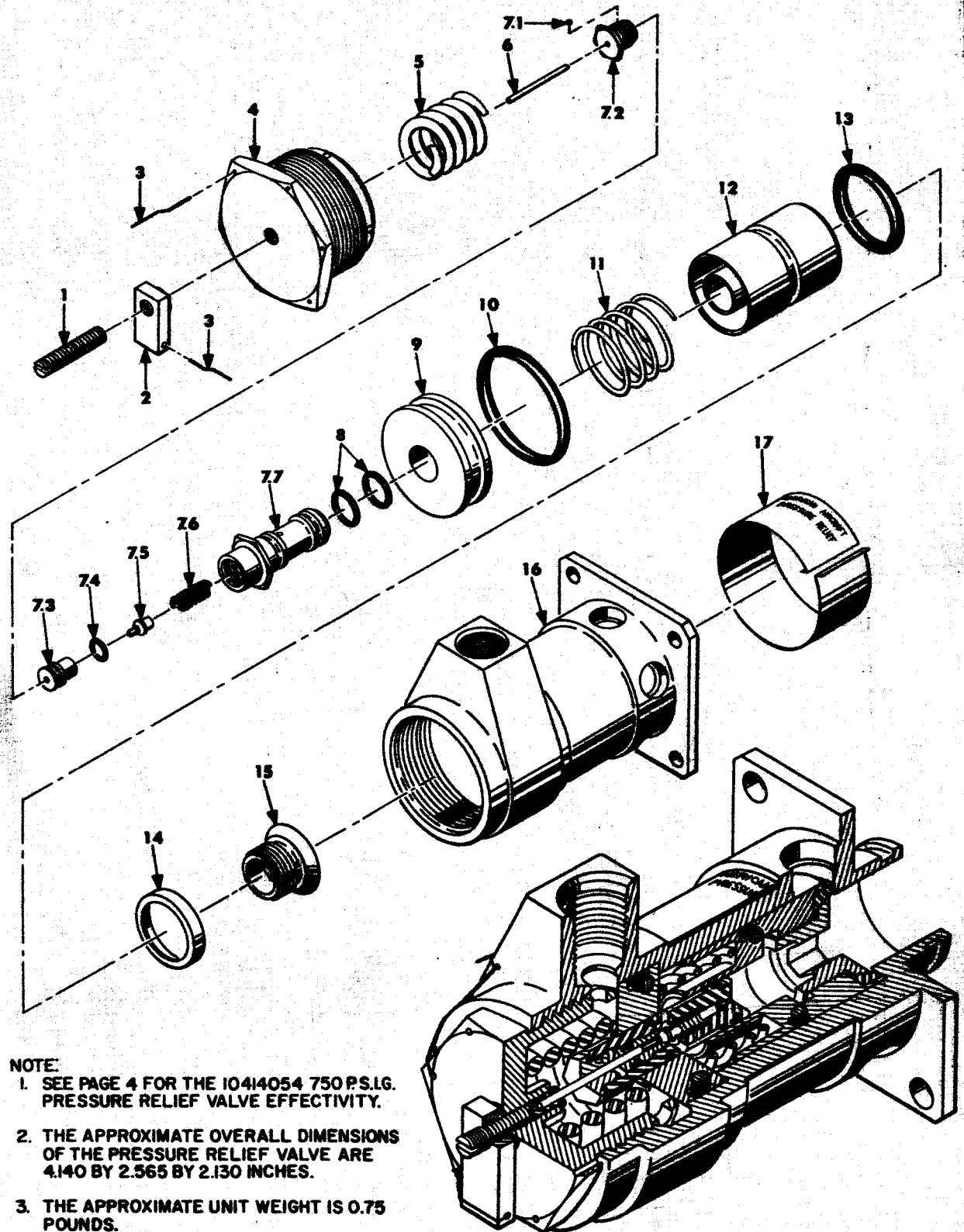
EP-140

PAGE

3

OF

4



REVISION DATE

M-ME-EP140-021

10414054

MSFC - Form 1151-2 (June 1961)

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve assembly are outlined in Performance Specification 10419946 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Military - MIL-E-5272
MIL-L-4343
MIL-Q-9858

3.2 Standards:

Military - MIL-STD-130
MIL-STD-643
MS33540
MS33586

3.3 Drawings:

Ordnance Corps - 10419918
10419946
10509302
10509305
10509311

EFFECTIVITY

VEHICLE	REVISIONS
SA-T	"B" Rev.
SA-1	"B" Rev.
SA-2	"B" Rev.
SA-3	"B" Rev.
SA-4	"B" Rev.
SPARES	Before installing modify to latest configuration

10414054

REVISION DATE

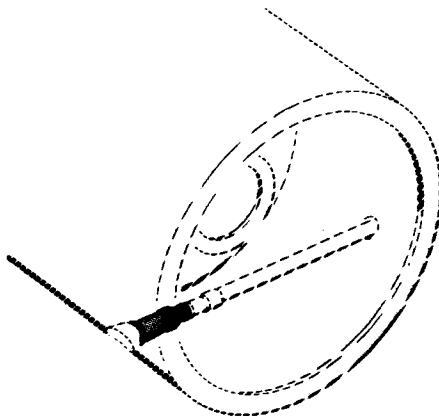
DATA SHEET	
Nomenclature: Valve, LOX Relief	
Drawing Numbers: 20M30460	Vendor: Calmec Mfg. Co.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: $7,716 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 129.6
Number of Components this Data Represents: 23	Total Cycles of Operation: 5,705
Number of Failures Reported: 44	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: (Same as on page 3, III.1.1)	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>27</u>	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish	<u>6</u>	Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
<u>11</u>	Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-10 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

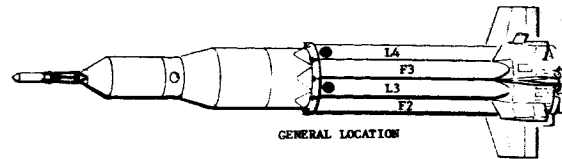
Additional information concerning the Relief LOX Valve, Drawing
Number 20M30460:

Forty failures were reported on Inspection Reports, four
were reported on Unsatisfactory Condition Reports.

MSFC	MANUFACTURING ENGINEERING DIVISION	NASA
MANUFACTURING PLAN		
TITLE SATURN I COMPONENTS ASSEMBLY PROCEDURE 20M30460 LOX RELIEF VALVE ASSEMBLY	DATE 3 April 1963 APPROVED <i>R. Paul</i>	PROCEDURE MPI-2000 PAGE 1 OF 4
<p>1. DESCRIPTION.</p> <p>The LOX relief valve assembly 20M30460 is a normally closed, spring loaded, poppet type valve. The valve is opened when an MV-74V control valve 20M30128 is signalled to pressurize the control chamber or when a predetermined flow chamber pressure is reached. The valve is used to maintain LOX container pressure during flight and to relieve the container pressure during the filling operation. The valve assembly is installed on containers L3 and L4 in the 4-inch vent assembly as shown in the installation view. The various functional characteristics of the LOX relief valve are as follows:</p> <p>1.1 <u>Flow Chamber Mechanical Performance Characteristics.</u> The relief valve flow chamber is capable of performing mechanically as follows:</p> <ul style="list-style-type: none"> a. Venting (cracking) relief operation: On increasing pressure at 55 p.s.i.g. the flow (not considered leakage) past the poppet must not be greater than 300 s.c.i.m. On further increase of pressure the poppet must vent (crack) at 57 +5 or -0 p.s.i.g. Venting is defined as a minimum flow of 4,250 s.c.i.m. of helium past the poppet. b. Closing (reseating) relief operation. After venting on decreasing pressure at 51 p.s.i.g. minimum the poppet must return to the closed position (reseat). Reseating is defined as a maximum flow of 240 s.c.i.m. of helium past the poppet. c. Operating temperature range: -250° to +250° F. d. Operating pressure: 62 p.s.i.g. minimum internal pneumatic pressure e. Proof operating pressure: 90 p.s.i.g. minimum internal pneumatic pressure. f. Burst pressure (without bursting): 150 p.s.i.g. minimum internal pressure. (CAUTION: Use only for destructive acceptance testing.) g. External leakage from the flow chamber: None when pressurized from 0 to the venting pressure. Flow past the poppet is not considered leakage. h. Service media: Air, GN₂, or gaseous oxygen. <p>1.2 <u>Pneumatic Override Mechanical Performance Characteristics.</u> The relief valve pneumatic override system is capable of performing mechanically as follows:</p> <ul style="list-style-type: none"> a. Minimum operating pressure: 600 p.s.i.g. internal pneumatic pressure. b. Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure. c. Proof operating pressure: 1,125 p.s.i.g. minimum internal pneumatic pressure. d. Burst pressure (without bursting): 1,875 p.s.i.g. minimum internal pressure. (CAUTION: Use only for destructive acceptance testing.) e. Operating temperature range: -250° to +250° F. 		
REVISION DATE	(Continued on page 4)	
		20M30460



INSTALLATION VIEW - LOOKING AFT
(TYPICAL ON CONTAINERS L3, & L4)



GENERAL LOCATION

LEGEND

- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH MSFC-SPEC-164.
- (B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) STAMP THE CURE DATE OF OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH MSFC-STD-105.
- (E) LUBRICATE THREADS WITH ANTISEIZE COMPOUND AR-1-F.
- (F) TORQUE 100 TO 110 INCH-POUNDS.
- (G) LOCKWIRE IN ACCORDANCE WITH MS33340.
- (H) OR APPROVED EQUIVALENT.
- (J) TORQUE 20 TO 25 INCH-POUNDS.
- (K) TORQUE 65 TO 70 INCH-POUNDS.
- (L) LUBRICATE WITH DRY MOLYKOTE, TYPE Z, POWER OR APPROVED EQUIVALENT. BLOW OFF EXCESS LUBRICANT WITH DRY NITROGEN GAS.
- (M) TORQUE TO 60 INCH-POUNDS.
- (N) COOL BUSHING IN LIQUID NITROGEN OR EQUIVALENT AND HEAT RETAINER TO 300-350° F. INSERT BUSHING INTO RETAINER.
- (P) SEAL ON BOTH SIDES WITH KKL-P-10-200 SEALING WAX OR APPROVED EQUIVALENT.
- (Q) LOCATE FLUSH TO 0.010-INCH BELOW THE SURFACE OF THE HOUSING.
- (R) LOCATE THE TOP SURFACE OF THE BURNED COLLAR 0.010- TO 0.020-INCH BELOW THE SURFACE OF THE HOUSING.
- (S) RADIOGRAPHICALLY INSPECT THE CASTING IN ACCORDANCE WITH MSFC-STD-100, GRADE II-F.
- (T) PRESSURE TEST THE MACHINED CASTING HYDROSTATICALLY TO 100 P.S.I.G. FOR 5 MINUTES AND PNEUMATICALLY TO 100 P.S.I.G. UNDER WATER FOR 5 MINUTES.
- (U) TORQUE TO 400 INCH-POUNDS.

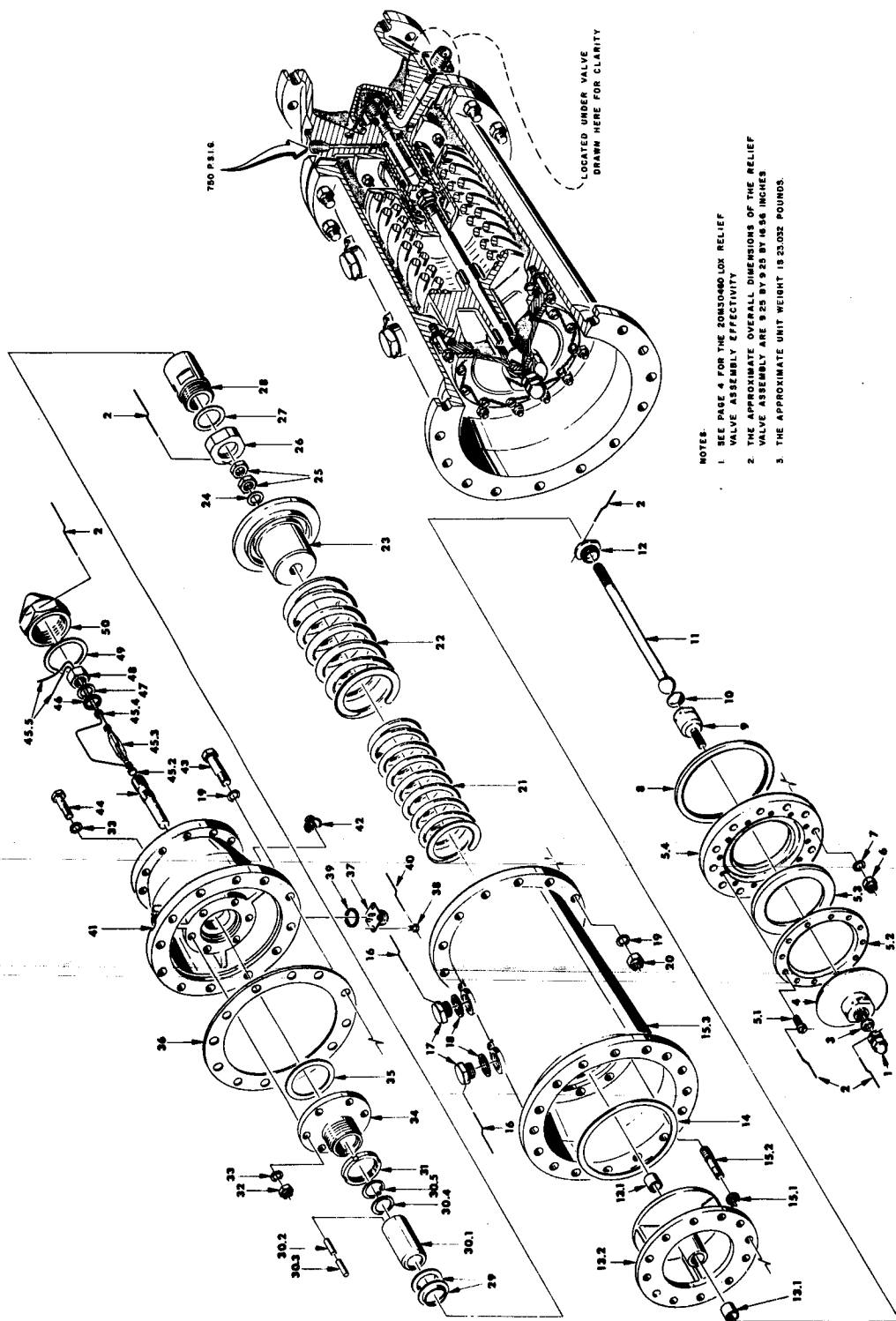
- (V) TORQUE 100 TO 140 INCH-POUNDS.
- (W) ADJUST SO THAT THE DISTANCE BETWEEN THE END OF THE SHAFT 20M30463-1 AND THE PISTON 20M30263 IS WITHIN 0.010-INCH MINIMUM AND 0.050-INCH MAXIMUM. THEN JAM TOGETHER BY HOLDING THE NUT NEAREST THE WASHER AND TORQUING THE OTHER 270 TO 300 INCH-POUNDS.
- (X) TORQUE 250 TO 300 INCH-POUNDS.
- (Y) TORQUE 275 TO 300 INCH-POUNDS.
- (Z) IF THE MAGNETIC SWITCH DOES NOT ACTUATE PROPERLY, REMOVE THE FOUR PISTON SPACERS AND FOUR BAR MAGNETS FROM THE PISTON AND CUT OFF APPROXIMATELY 0.100-INCH FROM THE SPACERS. INSERT THE CUT OFF PORTION OF THE SPACERS, THE MAGNETS, AND FINALLY THE REMAINDER OF THE SPACERS. THE AMOUNT TO BE CUT OFF AND INSERTED BEFORE THE MAGNETS MAY VARY DUE TO MAGNET CHARACTERISTICS.
- (AA) INSTALL WITH LIKE POLES NEAR THE DRILLED SURFACE OF THE PISTON.
- (AB) TORQUE 150 TO 200 INCH-POUNDS.
- (AC) FLUOROLUBE IN ACCORDANCE WITH SPECIFICATION DRAWING 10438101.
- (AD) PRESSURE TEST THE OVERSIZE CYLINDER HYDROSTATICALLY TO 1,125 P.S.I.G. FOR 5 MINUTES AND PNEUMATICALLY TO 1,125 P.S.I.G. UNDER WATER FOR 5 MINUTES.
- (AE) CONTINUE TURNING 1/4 TO 1/2 TURN AFTER THE FLAMER CONTACTS THE REAR HOUSING ASSEMBLY.
- (AF) ADJUST TO INDICATE THAT THE VALVE IS CLOSED WHEN THE POPPET IS WITHIN 0.100-INCH MAXIMUM AND 0.010-INCH MINIMUM OF SEATING.
- (AG) SOLDER BOTH ENDS OF SWITCH IN ACCORDANCE WITH MSFC-PROC-158.
- (AH) TORQUE 350 TO 400 INCH-POUNDS.
- (AJ) TORQUE TO 1,200 INCH-POUNDS.

20M30460

1. 20M30027
2. MS20995C32
3. 20M30035
4. 20M30464-1
5. 20M30467-1
- 5.1 NAS1351C3H6
- 5.2 20M30444-1
- 5.3 20M30461-1
- 5.4 20M30440-1
6. AN363C428
7. AN960C416
8. 20M30434
9. 20M30462-1
10. 20M30466-1
11. 20M30465-1
12. 20M30463-1
13. 20M30231
- 13.1 20M30262
- 13.2 20M30261
14. 20M30246
15. 20M30230
- 15.1 20M30023
- 15.2 20M30259
- 15.3 20M30251
16. MS20995C41
17. MC179D8W
18. 20M00420-8
19. AN960C516
20. AN363C524
21. 20M30248
22. 20M30247
23. 20M30234
24. AN960C716L
25. MS35691-730
26. 20M30239
27. 20M30240
28. 20M30235
29. 20M30241
30. 20M30232
- 30.1 20M30263
- 30.2 20M30030
- 30.3 20M30032
- 30.4 20M30029
- 30.5 20M30034
31. 20M30250
32. AN363C428
33. AN960C416
34. 20M30236
35. 20M30242
36. 20M30254
37. 20M30107
38. MS35276-13
39. MS28778-8
40. MS20995C20
41. 20M30256
42. 20M30028
43. AN5C14A
44. AN4C10A
45. 20M30005
- 45.1 20M30006
- 45.2 20M30008
- 45.3 20M30007
- 45.4 20M30214
46. AN6227-9
47. 20M30013
48. 20M30014
49. 20M30252
50. 20M30253

- LOX RELIEF VALVE ASSEMBLY ("A" REV., EO-1 & -2) (A) (B) (C) (D) (E)
- ACORN NUT (F)
- LOCKWIRE (G)
- SEAL (PRECISION RUBBER PRODUCTS CORP. 110-3/8) (H)
- POPPET ("A" REV.)
- SEAL ASSEMBLY ("A" REV. & EO-1)
- SCREW (12 PLACES) (J)
- PLATE RETAINER ("A" REV.)
- SEAL ("A" REV.)
- PLATE SEAL ("A" REV.)
- SELF LOCKING NUT (12 PLACES) (K)
- WASHER (12 PLACES)
- SEAL ("A" REV.) (RACO ENGRG. DIV. OF R. E. CREATH CO., INC., LOS ANGELES, CALIF., PART NO. 10003-84)
- POPPET ADAPTER ("A" REV.)
- PLUG ("A" REV.)
- SHAFT ("A" REV.) (L)
- SHAFT RETAINER ("A" REV.) (M)
- RETAINER ASSEMBLY (EO-1)
- RETAINER BUSHING (N)
- RETAINER (O)
- RETAINER GASKET (FLEXITALLIC GASKET CO., CAMDEN, N. J. RA-48) (P)
- LOX RELIEF VALVE NOISING ASSEMBLY LOCK RING (ROSAN INC., RL245B-7) (12 PLACES) (Q)
- STUD (ROSAN INC., SP101-9SA-19A) (12 PLACES) (R)
- FRONT HOUSING (S)
- LAC WIRE (T)
- SCREW THREAD PLUG AND BLEEDER (U)
- K-SEAL (HARRISON MANUFACTURING CO., BURBANK, CALIF. 1210088) (V)
- WASHER (12 PLACES)
- NUT (12 PLACES) (W)
- INNER SPRING
- OUTER SPRING
- RETAINER
- WASHER
- JAM NUT (X)
- SEAL RETAINER (Y)
- SEAL (EO-1)
- PISTON RETAINER (Z)
- PISTON LIP SEAL (EO-1 & -2)
- PISTON ASSEMBLY (AA)
- PISTON (AB)
- BAR MAGNET (REVERE CORP., OF AMERICA, WALLINGFORD, CONN. F-6972-3) (4 PLACES) (AC)
- MAGNET SPACER (4 PLACES)
- PISTON WASHER
- RETAINING RING (WALERS ROBINSON INC., LONG ISLAND CITY 1, N. Y. 3601-100-C-MF) (AD)
- RING (AE)
- SELF LOCKING NUT (6 PLACES) (AF)
- WASHER (6 PLACES)
- CYLINDER COVER
- COVER GASKET (FLEXITALLIC GASKET CO., CAMDEN, N. J. RA-3P) (AG)
- GASKET (EO-1) (AH)
- CONNECTOR (CAMSON ELECTRIC CO., LOS ANGELES, CALIF. 2802-108L-48-111) (AI)
- SCREW (4 PLACES)
- PREFORMED PACKING (O-RING) (AJ)
- LOCKWIRE (AK)
- REAR HOUSING ASSEMBLY (S) (T) (AD)
- VENT SEAL (EO-1) (AL)
- BOLT (12 PLACES)
- BOLT (6 PLACES)
- SWITCH ASSEMBLY (EO-1) (AM)
- SWITCH HOLDER (EO-1)
- SWITCH CUP (EO-1)
- SWITCH (REVERE CORP. OF AMERICA, F5600-23 or -33) (AN)
- SWITCH INSULATOR ELECTRICAL WIRING (MIL-W-16878, TYPE E, NICKEL PLATED AWG NO. 20) (AO)
- PREFORMED PACKING (O-RING) (B) (L)
- BACKUP WASHER (EO-1)
- SWITCH NUT (AP)
- SEAL (EO-1)
- CAP (S) (AJ)

DRAWN BY:	<i>James Potts</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 20M30460	REVISION DATE OF THIS PAGE
PLANNER:	<i>D.W. Thayer</i>	A	BO'S	
WRITER:	<i>A. L. Schenk</i>		-1 & -2	
APPROVED BY:	<i>M. K. Highsmith</i>		ART CONTROL NO. M-ME-E-1130-A	31 May 1963



- NOTES:
1. SEE PAGE 4 FOR THE 20M30460 LXX RELIEF VALVE ASSEMBLY EFFECTIVITY
 2. THE APPROXIMATE OVERALL DIMENSIONS OF THE RELIEF VALVE ASSEMBLY ARE 5.25 BY 2.25 BY 4.56 INCHES
 3. THE APPROXIMATE UNIT WEIGHT IS 23.032 POUNDS

20M30460

M-NE-E-1130

REVISION DATE

1.2 (con.)

- f. Leakage past control cylinder: 240 s.c.i.m. maximum of helium when the piston assembly is pressurized from 0 to 750 p.s.i.g.
- g. Poppet travel: 1.100-inches minimum when operated by the pneumatic control assembly.
- h. Clearance between the shaft and piston assembly: 0.010 to 0.050-inches.
- i. Service media: Air, GN_2 , or helium.
- j. Life cycle: 2,000 cycles of operation by the pneumatic control assembly without damage or impairment of performance.
- k. Poppet closing time: 2 seconds maximum after the control chamber is vented to relieve the 750 p.s.i.g. pressurization.

- 1.3 Electrical Performance Characteristics. The magnetic position switch indicates that the valve is closed when the poppet is within 0.100-inch maximum to 0.010-inch minimum of its seated position. A continuity check between pins "A" and "B" on the connector with the valve in the closed position must indicate less than 0.5 ohm resistance. With the valve in the open position the insulation resistance between pin "A" and valve body, pin "B" and the valve body, or pins "A" and "B" must be a minimum of 50 megohms with 500 v.d.c. applied. The switch operates from a 22 to 32 v.d.c. system with 28 v.d.c. nominal.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The relief valve is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 45 g's in each of the three major axes under the following condition:
10-milliseconds duration - triangular wave, or equivalent.

- 1.5 Vibration Withstanding Capability. The relief valve is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:
20 to 37 c.p.s. at 0.1-inch double amplitude displacement,
37 to 300 c.p.s. at 7.0 g's.
300 to 510 c.p.s. at 0.0015-inch double amplitude displacement, and
510 to 2,000 c.p.s. at 20.0 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests for the preparation for delivery of the relief valve are outlined in Performance Specification 10M01150 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

Federal - QQ-S571C/SN-60
 NASA - MSFC-SPEC-106
 MSFC-SPEC-164
 MSFC-PROC-158
 Military - MIL-E-5272
 MIL-W-16878

3.2 Standards:

Military - MIL-STD-130
 MS33540
 NASA - MSFC-STD-100
 MSFC-STD-105
 Army Ballistic Missile
 Agency - ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10509302
 MSFC - 10419909
 10M01150

EFFECTIVITY

VEHICLE	REVISIONS
SA-5	"A" Rev., EO-1 and -2
SA-6	"A" Rev., EO-1 and -2
SA-7	"A" Rev., EO-1 and -2
SA-8	"A" Rev., EO-1 and -2
SA-9	"A" Rev., EO-1 and -2
SA-10	"A" Rev., EO-1 and -2
SPARES	BEFORE INSTALLING MODIFY TO LATEST CONFIGURATION

20M30460

REVISION DATE **31 May 1963**

DATA SHEET	
Nomenclature: Valve, Interconnecting	
Drawing Numbers: 10414318 Saturn I Vehicle	Vendor: North American Aviation Clary Corp. Location: S-I Stage
Estimated Design Life: 2,000 cy.	
Failure Rate: 970 x 10 ⁻⁶ /cy. Number of Components this Data Represents: 14 Number of Failures Reported: 0	MCBF (in cycles): 1,031 Total Cycles of Operation: 1,428 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature: <u>140°F</u>	
Low Temperature: <u>-65°F</u>	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate: <u>20 scim shaft seal at 150 psig</u>	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20-55 cps at 5 g. 55-110 cps at 0.03 D.A.d.,</u> <u>110-2,000 cps at 20 g</u>	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: IN-P&VE-E-62-5, January 21, 1962, MSFC			

MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN		DATE	PROCEDURE NO.
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414318 LOX INTERCONNECT VALVE AND ORIFICE ASSEMBLY		1 September 1961	EP-140
		APPROVED <i>R. Baetz</i>	PAGE 1 OF 4

1. DESCRIPTION.

The LOX interconnect valve and orifice assembly 10414318 is a normally closed pneuma-mechanically operated orificed-gate type valve. All four of the valve and orifice assemblies are opened during the LOX container filling or draining operation. The valves are opened when the solenoid in a single MV-74V control valve 10414027 is energized to allow GN₂ from the control pressure system to pressurize the control ports of the four valve and orifice assemblies. When the valve and orifice assemblies are closed the orifices in their gates restrict the flow of GOX into the 70-inch LOX containers to maintain a higher pressure in container LC. The higher pressure forces the LOX in container LC out into the 70-inch containers before they are emptied. The valves are used in the LOX interconnect valve and orifice and spacer assemblies 10438179. The valve and orifice assemblies are installed in the four branch lines above container LC as shown in the installation view. The various functional characteristics of the valve and orifice assembly are as follows:

1.1 Mechanical Performance Characteristics. The valve and orifice assembly is capable of performing mechanically as follows:

- Operating line pressure: 65 p.s.i.a.
- Gate play: 1° maximum.
- Parallelism between the surface of the closed gate and the flat machined surface of valve housing: $\pm 0^\circ 30'$
- Service: GOX
- Nominal vent gate operating time, switch to switch:
 - To open - 150 milliseconds.
 - To close - 300 milliseconds.
- Internal leakage with 60 p.s.i.g. pressure in the line and the gate in both the open and closed positions alternately:
 - Shaft seals - 20 s.c.i.m. maximum.
 - Gate pin seals - 2 s.c.i.m. maximum.
 - Main seat - 25 s.c.i.m. maximum (applies only with gate in the closed position).
- Venting chamber operating temperature range: -150° to +165° F.

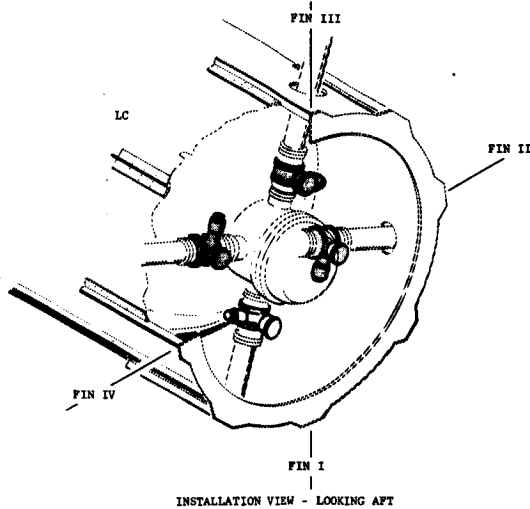
1.2 Pneumatic Operating Characteristics. The valve and orifice assembly is capable of operating pneumatically as follows:

- Control cylinder operating temperature range: -65° to +165° F.
- Minimum operating pressure: 500 p.s.i.g. internal pneumatic pressure.
- Nominal operating pressure: 750 p.s.i.g. internal pneumatic pressure.
- Proof operating pressure: 1,125 p.s.i.g. internal pneumatic pressure.
- Burst pressure (without bursting): 1,875 p.s.i.g. internal hydrostatic pressure. (CAUTION: Use only for destructive acceptance testing.)
- Operating media: Air, gaseous nitrogen, or helium.
- Leakage past the control cylinder: 5 s.c.i.m. maximum with 750 p.s.i.g. internal pneumatic pressure applied.

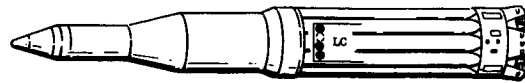
1.3 Electrical Performance Requirements. The electrical performance requirements of the valve and orifice assembly are as follows:

(Continued on page 4)

MANUFACTURING PLAN



INSTALLATION VIEW - LOOKING AFT

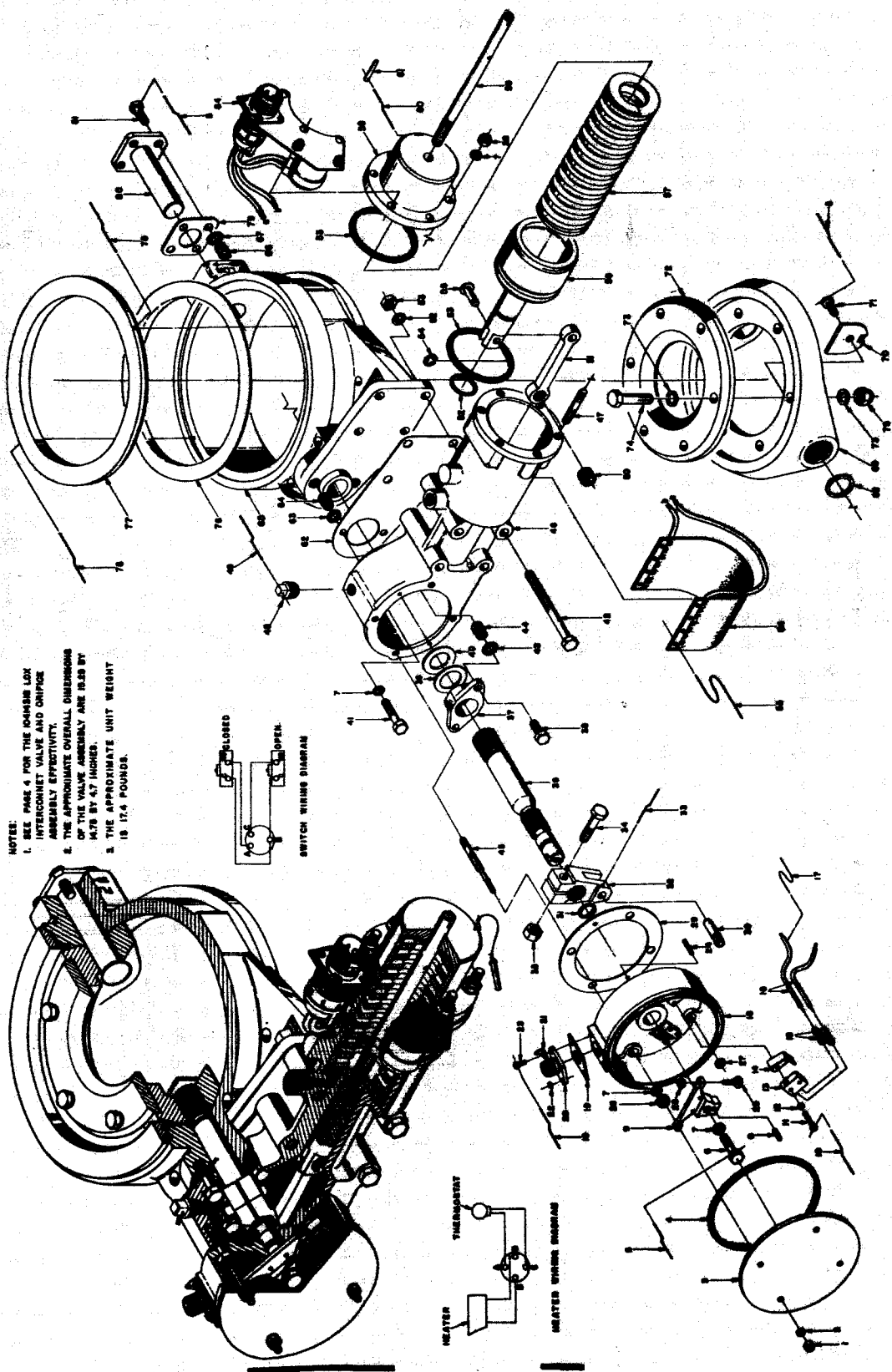


GENERAL LOCATION

LEGEND (CON.)

- NOTES**
- (A) CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- (B) ALL MATERIALS OTHER THAN SEALANTS MUST MEET THE REQUIREMENTS FOR COMPATIBILITY WITH LOX IN ACCORDANCE WITH MSFC-SPEC-106.
- (C) IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- (D) STAMP THE CURIE DATE OF THE OLDEST PREFORMED RUBBER PACKING SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- (E) CARE MUST BE TAKEN TO PREVENT CONTAMINATION DURING ASSEMBLY.
- (F) OR APPROVED EQUIVALENT.
- (G) TORQUE 16 TO 20 INCH-POUNDS.
- (H) LUBRICATE WITH DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.
- (J) LOCKWIRE IN ACCORDANCE WITH MS33540.
- (K) TORQUE 50 TO 70 INCH-POUNDS.
- (L) TORQUE 15 TO 18 INCH-POUNDS.
- (M) SPOT-TIE THE ELECTRICAL WIRES AT 3-INCH INTERVALS.
- (N) TORQUE 6 TO 8 INCH-POUNDS.
- (P) TORQUE 10 TO 12 INCH-POUNDS.
- (Q) INSTALL UNDER THE NUT PLACED HERE AND ON THE OPPOSITE SIDE OF THE BOX, INSTALL WASHER 2W18-416 UNDER THE TWO REMAINING NUTS.
- (R) TORQUE 50 TO 70 INCH-POUNDS.
- (S) POSITION THIS LEVER SO THAT THE SPLINE INDEX SCRIBE MARK IS IN LINE WITH THE PUNCH MARK SHOWN ON THE SHAFT.
- (T) TORQUE 100 TO 140 INCH-POUNDS.
- (U) TORQUE TO 50 INCH-POUNDS.
- (V) PRIOR TO INSTALLING THE VALVE GATE AND SHAFT, PLACE THIS SEAL BLANK IN THE CASTING 9615-48013-9 AND RETAIN WITH THE RETAINER 9615-48024. WITH BOTH VALVES TOGETHER, FORCE THE TOOL 365-798 THROUGH THE SEAL BLANK TO FORM THE SEAL. REMOVE THE TOOL AND SEAL TOGETHER. INSTALL THE SHAFT AND SLIP THE FORMED SEAL FROM THE TOOL TO THE SHAFT BY USING THE RETAINER 9615-48024.
- (W) LUBRICATE WITH ALPHA MOLYKOTE CORP., MOLYKOTE TYPE Z POWDER OR APPROVED EQUIVALENT. BLOW OFF EXCESS LUBRICANT WITH DRY NITROGEN GAS.
- (X) TORQUE TO 43 INCH-POUNDS.
- (Y) TORQUE 22 TO 30 INCH-POUNDS.
- (Z) TORQUE 70 TO 120 INCH-POUNDS.
- (AA) ADJUST SO THAT WHEN THE PISTON IS IN THE CLOSED POSITION THE GATE IS COMPLETELY CLOSED - TOP SURFACE OF THE GATE, PARALLEL WITH THE TOP SURFACE OF THE GATE HOUSING WITHIN PLUS OR MINUS ZERO DEGREES 30 MINUTES.
- (AB) TORQUE 50 TO 55 INCH-POUNDS.
- (AC) TORQUE 20 TO 25 INCH-POUNDS.
- (AD) WIRE RING TO HOUSING TWO PLACES AS REQUIRED.
- (AE) TORQUE TO 85 INCH-POUNDS MAXIMUM.
- (AF) LACE HEATER ASSEMBLY BLANKET TO PISTON HOUSING ASSEMBLY AS REQUIRED.
- LEGEND**
- 10414318 LOX INTERCONNECT VALVE AND ORIFICE ASSEMBLY ("B" REV. & EO-3) (NORTH AMERICAN AVIATION INC. NO. 9512-48410-61) (A) (B) (C) (D) (E) (F)
1. NAS679A08W NUT (4 PLACES) (C) (F)
2. 800-015-8 LOCK-O-SEAL (4 PLACES) (F)
3. 9512-48065 COVER
4. AM6230B22 PREFORMED PACKING (O-RING) (F) (H)
5. MS20995M40 LOCKWIRE (J)
6. AN4N10A BOLT
7. 2W18-416 WASHER
8. 9512-48425 VALVE SWITCH ARM ASSEMBLY
- 2P9-7-7 PIN
9. 9512-48425-3 ARM
- 9512-48429 SWITCH ASSEMBLY
10. AN995W20 LOCKWIRE (J)
11. AN500A2-10 SCREW (4 PLACES) (L)
12. 2W1C6-8-16 WASHER (4 PLACES)
13. 28E6 MICRO SWITCH (MICRO SWITCH CORP.) (2 PLACES) (F)
14. JE-1 ACTUATOR (MICRO SWITCH CORP.) (2 PLACES) (F)
15. INSULATION TUBING
16. ELECTRICAL WIRING
17. TYING CORD (M)
18. BOX
19. 10-40450-10 GASKET (BENDIX AVIATION CORP.) (F)
20. MS3102E10SL3P CONNECTOR (REPLACES THE VENDOR FURNISHED AN3102E10SL3P CONNECTOR)
21. RD191-4002-0001 LUG (REPLACES PART NO. R2-1-1) (F)
22. 2W18-4 WASHER (3 PLACES)
23. AN500A4-6 SCREW (4 PLACES) (N)
24. AN122676 PIN
25. 9612-48422 SETSCREW (2 PLACES)
26. AN340-6 NUT (2 PLACES) (F) (Q)
27. 2W1AL17-20-62 WASHER (2 PLACES)
28. NAS679A4W NUT (R)
29. 9615-48030 GASKET
30. 9615-48427 PIN (H)
31. AM622789 PREFORMED PACKING (O-RING) (F) (H)
32. 9512-48426 LEVER (S)
33. MS20995M51 LOCKWIRE (J)
34. AN5-12A BOLT
35. NAS679A5 NUT (T)
36. 9512-48431 SHAFT
37. 9615-48024 RETAINER
38. AN4-5A BOLT (2 PLACES) (U)
39. 9615-48269 WASHER
40. 9615-48062 SEAL (V) (W) (X)
41. AN4-11A BOLT (2 PLACES)
42. AN5-32A BOLT (4 PLACES)
43. 9615-48013-51 PISTON HOUSING ASSEMBLY
44. K2-6-1 RING (2 PLACES) (Y) (Z)
45. L1246-1-6 INSERT (2 PLACES) (F)
46. 9615-48068 STUD (4 PLACES) (Y)
47. 400496 CASTING
48. MS20913-1D STUD (6 PLACES) (Y)
49. MS20995C32 SQUARE HEAD PIPE THREAD PLUG (REPLACES THE VENDOR FURNISHED AN816-4C NIPPLE) (Z)
50. 9615-48266 LOCKWIRE (J)
51. 9512-48432 BUSHING (H) (AA)
52. AN6227B13 LINK (H) (AA)
53. AN6230B6 PREFORMED PACKING (O-RING) (F) (H)
54. X5133-31MF PREFORMED PACKING (O-RING) (F) (H)
55. 9512-48014 RING (WALDES KOHNOR INC.) (F) (H)
56. 402658 PIN (H)
57. 9-3224-11 PISTON ASSEMBLY (H)
58. 402656 SPRING
59. 402657 CYLINDER CAP
60. MS20995M32 BOLT (AD)
61. 20M30382 LOCKWIRE (J)
62. 9627-48497 TAPER PIN (MAKE FROM MS24692-155D) (REPLACES THE VENDOR FURNISHED PIN AN385ARI077)
63. 9512-48411 GASKET
64. RL288B-8 HOUSING ASSEMBLY
65. RD2068B-6-5L RING (2 PLACES) (F)
66. 9512-48411 INSERT (2 PLACES) (F)
67. R2068B-8 HOUSING
68. RL288B-8 INSERT (4 PLACES) (F)
69. 9512-48424 RING (4 PLACES) (F)
70. 10414509 WASHER
71. 9615-48074-3 GATE (EO-1A) (REPLACES THE VENDOR FURNISHED 9615-48591-3 GATE)
72. AN3H3A WASHER (AC)
73. 10414510 ORIFICE ("A" REV.)
74. AN960C516 WASHER (6 PLACES)
75. AN5C12A BOLT (6 PLACES)
76. AN363C524 NUT (6 PLACES) (T)
77. 9615-48107 SEAL (M)
78. 9512-48413 RING
79. MS20995M91 LOCKWIRE (AD)
80. 9512-48360 GASKET
81. 9615-48020 PIN (U)
82. AN4H5A BOLT (4 PLACES) (AE)
83. 2W18-516 WASHER (4 PLACES)
84. NAS679A5 NUT (4 PLACES) (Z)
85. 9512-48430 HEATER ASSEMBLY (REMOVE THE AN3100E16-9P CONNECTOR AND REPLACE WITH MS3100E16-9P) (AF)
- BRASS WIRE (MIL-QQ-W-321, COMP. A)

DRAWN BY:	<i>G. B. Bopp</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414318	REVISION DATE OF THIS PAGE
PLANNER:	<i>John E. Bennett</i>		EO's -3	
WRITER:	<i>G. J. Schreck</i>	B	ART CONTROL NO. M-F&AE-EP140-511-A	
APPROVED BY:	<i>M. J. Schreck</i>			8 Dec. 1961



- NOTES:
1. SEE PAGE 4 FOR THE DIMENSION FOR INTERCONNECT VALVE AND ORNIP ASSEMBLY EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE VALVE ASSEMBLY ARE 18.50 BY 14.75 BY 4.75 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 11.4 POUNDS.

MANUFACTURING PLAN

- a. Switch actuation: At $1^0 \pm 0^030'$ before the gate is in its completely open or closed position.
- b. The heater and switch wiring diagrams are shown on page 3.

CAUTION: Paragraphs 1.4 and 1.5 constitute destructive test items that are performed only at the option of the procuring activity.

- 1.4 Shock Withstanding Capability. The valve and orifice assembly is designed to withstand, without damage or impairment of performance, six shocks of one of the following durations and wave forms at 35 g's in each of the three major axes:

10-milliseconds duration - triangular wave, or
 8-milliseconds duration - sine wave, or
 6-milliseconds duration - square wave.

- 1.5 Vibration Withstanding Capability. The valve and orifice assembly is designed to withstand, without damage or impairment of performance, vibration at each resonant frequency for 5 minutes duration in each of the three major axes under the following conditions:

20 to 55 c.p.s. at 3 g's,
 55 to 100 c.p.s. at 0.02-inch double amplitude displacement, and
 100 to 2,000 c.p.s. at 10 g's.

2. TEST AND DELIVERY REQUIREMENTS.

The destructive and nondestructive acceptance tests and the preparation for delivery of the valve are outlined in Performance Specification 10419910 and Packaging and Packing Specification 10509302.

3. REFERENCES.

3.1 Specifications:

NASA - MSFC-SPEC-106
 Rocketdyne - RA0113-001

3.2 Standards:

Military - MIL-STD-130
 MS33540
 Army Ballistic Missile Agency
 ABMA-STD-18

3.3 Drawings:

Ordnance Corps - 10419909
 10419910
 10509302
 10509303
 10509305
 10509311

EFFECTIVITY OF 10414318

VEHICLE	REVISIONS
SA-T	"B" Rev. and EO-3
SA-1	"B" Rev. and EO-3
SA-2	"B" Rev. and EO-3
SA-3	"B" Rev. and EO-3
SA-4	"B" Rev. and EO-3
Spares	Before installing modify to latest configuration

10414318

REVISION DATE 8 DEC. 1961

DATA SHEET	
Nomenclature: Valve, Safety	
Drawing Numbers: 10414350	Vendor: Cornelius Co.
Saturn I Vehicle	Location: Payload
Estimated Design Life: 2,000 cy.	
Failure Rate: $26,666 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 37.5
Number of Components this Data Represents: 6	Total Cycles of Operation: 52
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Ruptured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

MSFC FABRICATION AND ASSEMBLY ENGINEERING DIVISION		NASA	
MANUFACTURING PLAN		DATE 9 Nov. 1961	PROCEDURE NO. EP-140
TITLE SATURN COMPONENTS ASSEMBLY PROCEDURE 10414350 SAFETY VALVE		APPROVED <i>P. Paul</i>	PAGE 1 of 4

1. DESCRIPTION

The safety valve 10414350 is a component of the regulator assembly 10410836 in the alpha meter clearing line. Gaseous nitrogen from the payload high pressure storage sphere flows through the regulator assembly into the alpha meters to check and clear the meters prior to liftoff. The safety valve is used in the alpha meter clearing line to relieve any excess pressure that may occur. When the pressure in the system reaches 575 plus or minus 25 p.s.i.g., the safety valve opens. The safety valve closes at a minimum pressure of 500 p.s.i.g. The safety valve is located in the payload aft section as shown in the installation view. The various functional characteristics of the safety valve are as follows:

Operating Characteristics. The safety valve is capable of operating as follows:

- Operating temperature range: -65° to +160° F.
- Service medium: Gaseous nitrogen.
- Safety valve opening pressure: 575 ± 25 p.s.i.g.
- Safety valve closing pressure: 500 p.s.i.g. minimum.

2. DELIVERY REQUIREMENTS

The preparation for delivery of the safety valve is outlined in Packaging and Packing Specification 10509302.

3. REFERENCES

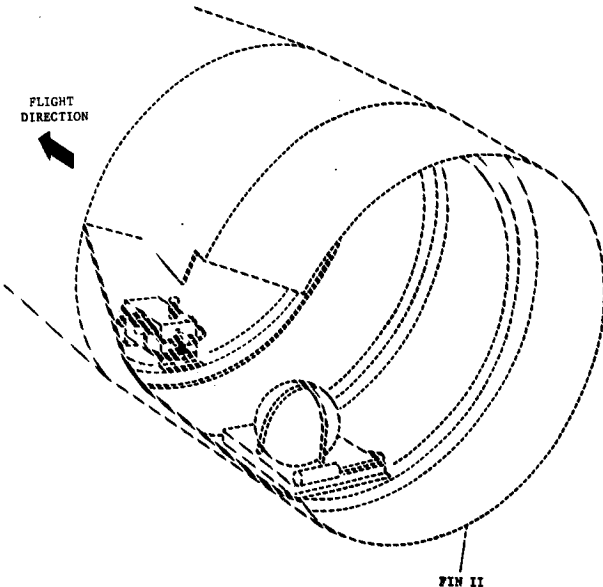
3.1 Standards:

Military - MIL-STD-130
MS33540

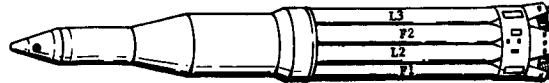
3.2 Drawings:

Ordnance Corps - 10509302
10509305
10509311

10414350

FLIGHT
DIRECTION

INSTALLATION VIEW - PAYLOAD SECTION



GENERAL LOCATION

NOTES

- A CLEAN AND CONDITION ALL METALLIC AND NONMETALLIC SURFACES IN ACCORDANCE WITH SPECIFICATION DRAWING 10509305.
- B IDENTIFY BY MARKING IN ACCORDANCE WITH MIL-STD-130.
- C STAMP THE CURE DATE OF THE OLDEST PREFORMED RUBBER SEAL IN ACCORDANCE WITH SPECIFICATION DRAWING 10509311.
- D CARE MUST BE TAKEN TO PREVENT CONTAMINATION BY FOREIGN MATTER.
- E OR APPROVED EQUIVALENT.
- F LOCKWIRE IN ACCORDANCE WITH MS33540.
- G ADJUST THE STEM AND ADJUSTING SCREW UNTIL THE VALVE OPENS AT 575 PLUS OR MINUS 25 P.S.I.G. AND CLOSES AT 500 P.S.I.G. MINIMUM.
- H LUBRICATE THE EXTERNAL SURFACE WITH DOW-CORNING CORP., D.C. 55 OR APPROVED EQUIVALENT.
- J LUBRICATE BY APPLYING A THIN FILM OF DOW-CORNING CORP. D.C. 55 OR APPROVED EQUIVALENT.

LEGEND

10414350

1. MS20995C32
2. 118-A-108
3. 118-A-107
4. 118-A-109-2
5. 118-A-106
6. 118-A-110.0
7. 216CP12
8. 118-A-103
9. AN6227-9
10. 118-A-101

SAFETY VALVE (RO-1) (THE CORNELIUS CO., MINNEAPOLIS 14, MINNESOTA, 118-B-100-5)

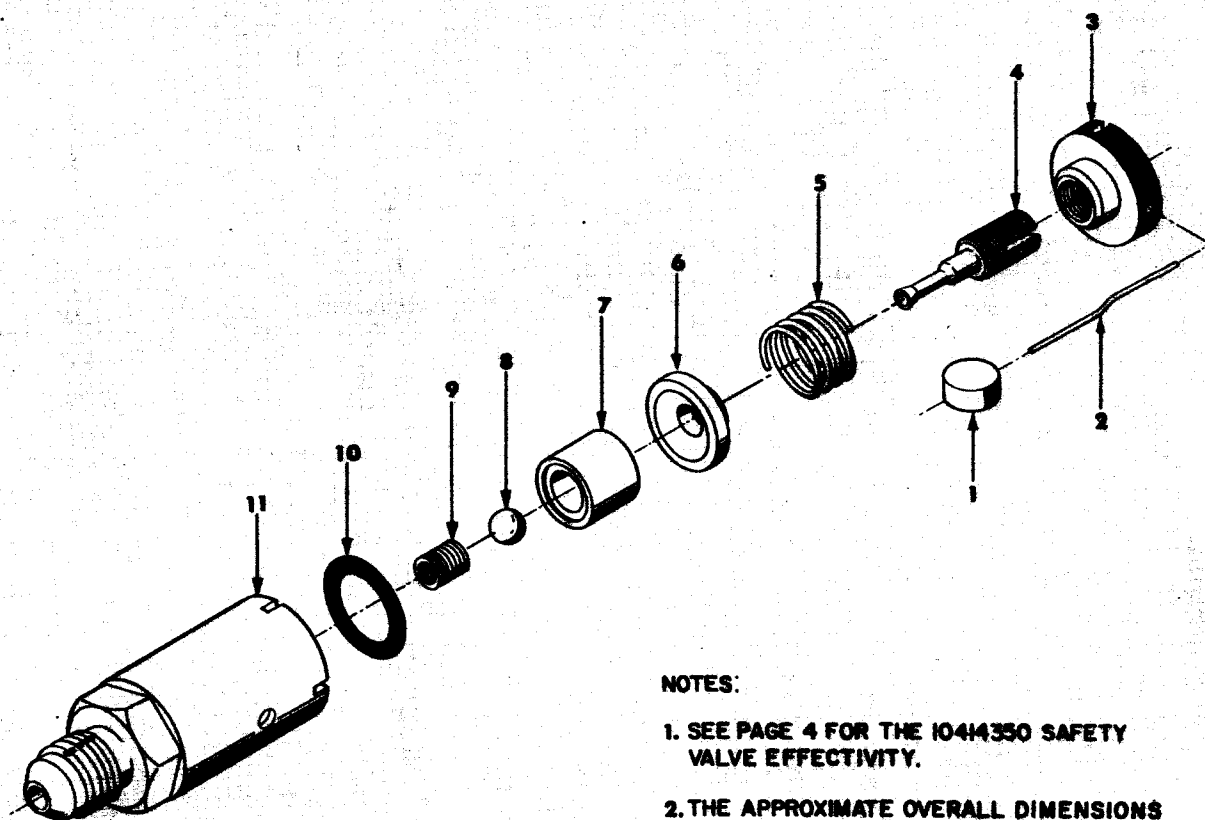
A B C D E
5/16-INCH DIAMETER SLOTTED LEAD SEAL
LOCKWIRE F
ADJUSTING SCREW G
STEM H
SPRING
SPRING RETAINER
PISTON ASSEMBLY I
BALL
SPRING
PREFORMED PACKING (O-RING) J
BODY

DRAWN BY:	<i>H. H. Rhodes</i>	ENGINEERING DRAWING RELEASE	REVISION TO: 10414350	REVISION DATE OF THIS PAGE
PLANNER:	<i>W. G. Bennett</i>		EO's	
WRITER:	<i>B. J. Cawley</i>		-1	
APPROVED BY:	<i>M. J. Lipton</i>		ART CONTROL NO. M-F&AE-EP140-560	

MANUFACTURING PLAN

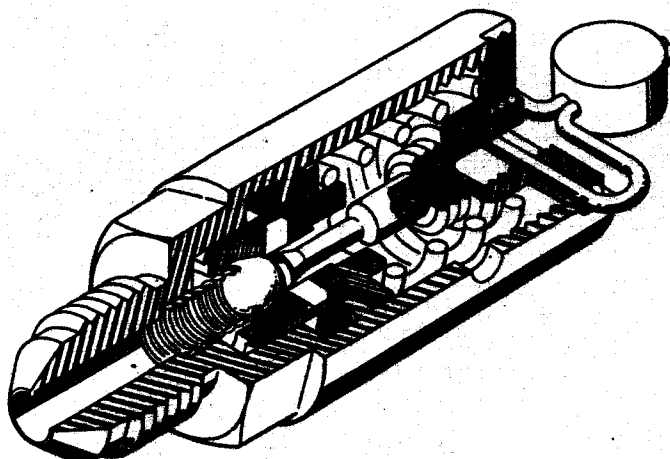
PROCEDURE EP-140

PAGE 3 OF 4



NOTES:

1. SEE PAGE 4 FOR THE 10414350 SAFETY VALVE EFFECTIVITY.
2. THE APPROXIMATE OVERALL DIMENSIONS OF THE SAFETY VALVE ARE 0.75 BY 0.75 BY 2.00 INCHES.
3. THE APPROXIMATE UNIT WEIGHT IS 0.062 POUNDS.



M-FBAE+EP140-560

10414350

EFFECTIVITY OF 10414350

VEHICLE	REVISIONS
SA-T	EO-1
SA-1	EO-1
SA-2	EO-1
SA-3	EO-1
SA-4	EO-1
Spares	Before installing modify to latest configuration

10414350

DATA SHEET	
Nomenclature: Gimbal Assy.	
Drawing Numbers: 202119	Vendor: Not Available
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: Not Available	
Failure Rate: $534 \times 10^{-6}/\text{cy.}$	MCBF (in cycles): 1,873.6
Number of Components this Data Represents: 12	Total Cycles of Operation: 2,595
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

III.4.1
Page 1 of 2

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Turbopump Assembly	
Drawing Numbers: 454105, 458412, 456405-21, 456405-51, 456405-11, 456405-31 Saturn I Vehicle	Vendor: North American Aviation, Rocketdyne Div. Location: S-1 Stage
Estimated Design Life: 0.5 hr.	
Failure Rate: 217,391 $\times 10^{-6}/\text{hr.}$ Number of Components this Data Represents: 43 Number of Failures Reported: 0	MTBF (in hours): 4.6 Total Hours of Operation: 6.4 Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No Data Available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

December 1965

Nomenclature:			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

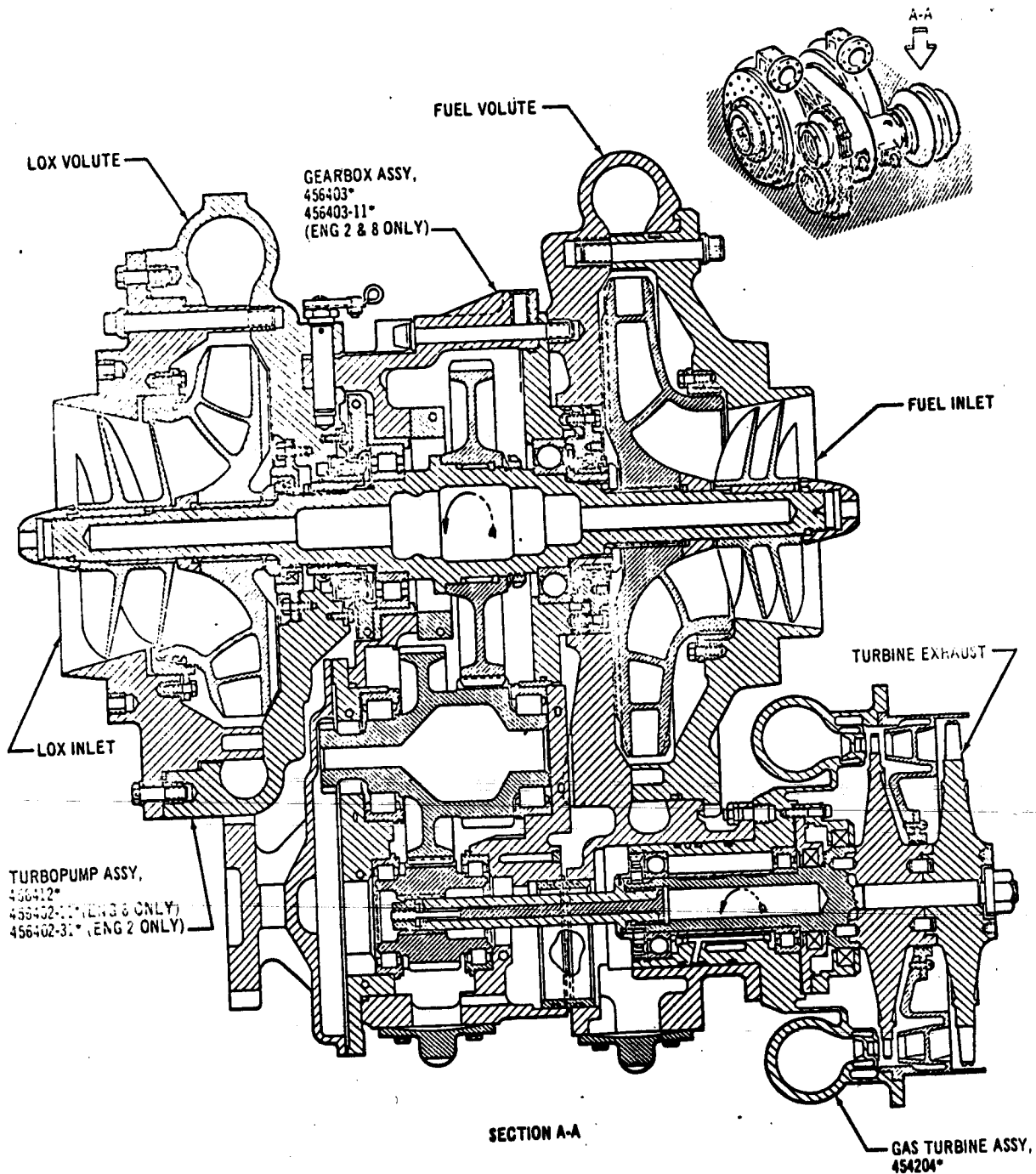
Additional information concerning the Turbopump Assembly, Part Nos. 458412, 456405-11, and 456405-31

The turbopump assembly consists of a fuel pump, oxidizer pump, gearbox with reduction gears, accessory drive adapter, and a gas turbine.

Hot gases from the gas generator operate the gas turbine that drives the reduction gears in the gearbox to supply power to the shaft on which the axial inducers and centrifugal impellers of the oxidizer and fuel pumps are mounted. Rotation of these inducers and impellers pumps the propellants to the desired pressure. Lubrication and cooling of the gears and bearings is accomplished by a fuel and oronite mixture supplied by the fuel additive blender unit.

The gas turbine is an impulse type, two-stage unit started by a solid propellant gas generator and sustained by a liquid propellant gas generator consisting of the gas generator control valve and the gas generator combustion chamber assembly.

1. Vendor - Rocketdyne Division, North American Aviation, Inc., Part Nos. 458412, 456405-11, and 456405-31
2. Location - Station 85
3. Service - LOX, RP-1 fuel, and oronite
4. Temperature - Operating:
 - a. Turbine inlet:
 - (1) Operating: $1200 \pm 50^{\circ}\text{F}$
 - (2) Maximum: 1400°F
 - b. LOX:
 - (1) Start: Maximum -285°F
 - (2) Otherwise: Maximum -275°F
5. Pressure -
 - a. Turbine inlet: Static, 400 to 600 psig
 - b. LOX pump:
 - (1) Operating inlet: 60 ± 5 psig
 - (2) Minimum inlet: 50 psig
 - (3) Maximum outlet: 1000 psig
 - c. Fuel pump:
 - (1) Operating inlet: 45 ± 5 psig
 - (2) Minimum inlet: 25 psig
 - (3) Maximum outlet: 1150 psig
 - d. Gearcase internal pressure (Tap G-1)
 - (1) Maximum: 10 psig
 - (2) Minimum: 2 psig
6. Lubrication - RP-1 fuel and oronite 262 (Oronite Chemical)
7. Leakage - None



*RCA ROCKETDYNE DIVISION

TURBOPUMP ASSEMBLY, 458412, 456405-11, AND
456405-31 - SECTIONAL VIEW

SUMMARY SHEET

Nomenclature: Pump, Auxiliary Hydraulic

Drawing Numbers: 10415082,
20M85005, 20M85064

Vendor: Vickers Inc.

Saturn I Vehicle

Location: S-1 Stage

Estimated Design Life: 100 hr.

Failure Rate: $21,321 \times 10^{-6}/\text{hr.}$

MTBF (in hours): 46.9

Total Number of Components
this Data Represents 49*

Total Hours of Operation:
281.7

Total Number of
Failures Reported 6

Vehicle Equipment: X
Ground Equipment:

Estimated Design Life: 6,000 cy.

Failure Rate: $1,832 \times 10^{-6}/\text{cy.}$

MCBF (in cycles): 545.8

Total Number of Components
this Data Represents: 29**

Total Cycles of Operation:
3,275

Total Number of
Failures Reported: 6

Vehicle Equipment: X
Ground Equipment:

* Forty-nine components were tested and monitored in hours. These components were taken from the SA-2 through SA-10 vehicles.

The failures reported could not be broken down into specific modes of operation in increments of time or cycles.

** Twenty-nine components were tested and monitored in cycles. These components represent the SA-4 through SA-9 vehicles. These 29 components are included in the forty-nine listed below.

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Nomenclature:			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction	<u>2</u> <u>3</u>	Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 through SA-10 vehicle (less flight data)			

DATA SHEET	
Nomenclature: Pump, Auxiliary	
Drawing Numbers: 10415082	Vendor: Vickers Inc.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: 20,000 x 10 ⁻⁶ /hr.	MTBF (in hours): 50
Number of Components this Data Represents: 10	Total Hours of Operation: 69.3
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED:	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock: <u>100 g - 6 ms square wave</u>	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration: <u>20 - 150 cps at 4 g for 30 secs.; 150 - 475 cps</u> <u>at 0.0035" D.A. for 1 min.; 475 - 2000 cps at</u> <u>40 g for 2.5 min.</u>	

Nomenclature: Pump, Auxiliary			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-2 and SA-3 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE: IN-P&VE-E-62-5, January 21, 1962, MSFC			

DATA SHEET	
Nomenclature: Pump, Auxiliary Hydraulic	
Drawing Numbers: 20M85064	Vendor: Vickers Inc.
Saturn I Vehicle	Location: S-1 Stage
Estimated Design Life: 100 hr.	
Failure Rate: 32,051 $\times 10^{-6}$ /hr.	MTBF (in hours): 31.2
Number of Components this Data Represents: 35	Total Hours of Operation: 187.2
Number of Failures Reported: 6	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as Page 3, III.5.2	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Pump, Auxiliary Hydraulic			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
<u>1</u>	Impedance:	<u>2</u> <u>3</u>	Pressure:
	Low		High
	High		Low
	Output:		None
	Distorted		Input:
	Erratic		Inoperative
	Excessive Null		Fuses:
	Excessive Roll		Blows/Blown
	Unwanted Signal		Blowers:
	High		Inoperative
	In Error		Intermittent
	Intermittent		Mechanical:
	Loss of Some Voltages		Pins Shorted
	Low		Indicators/ Dials Are In Error
	Low Sensitivity		Indicators/ Dials Are In- operative
	Low Speed		Lamps:
	No Lock On (Frequency)		Will Not Light
	Noisy		Stay On
	None		Miscellaneous:
	Oscillation/Fluctuation		Reported as Burned Parts
	Out of Specs		Other:
	Out of Synchronization		
	Over Modulation		
	Overspeed		
	Regulation		
	Shorted		
	Reverses Polarity		
	Reverses Direction		
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
SA-5 through SA-10 Vehicles (less CALENDAR TIME DATA REPRESENTS: flight vehicles)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

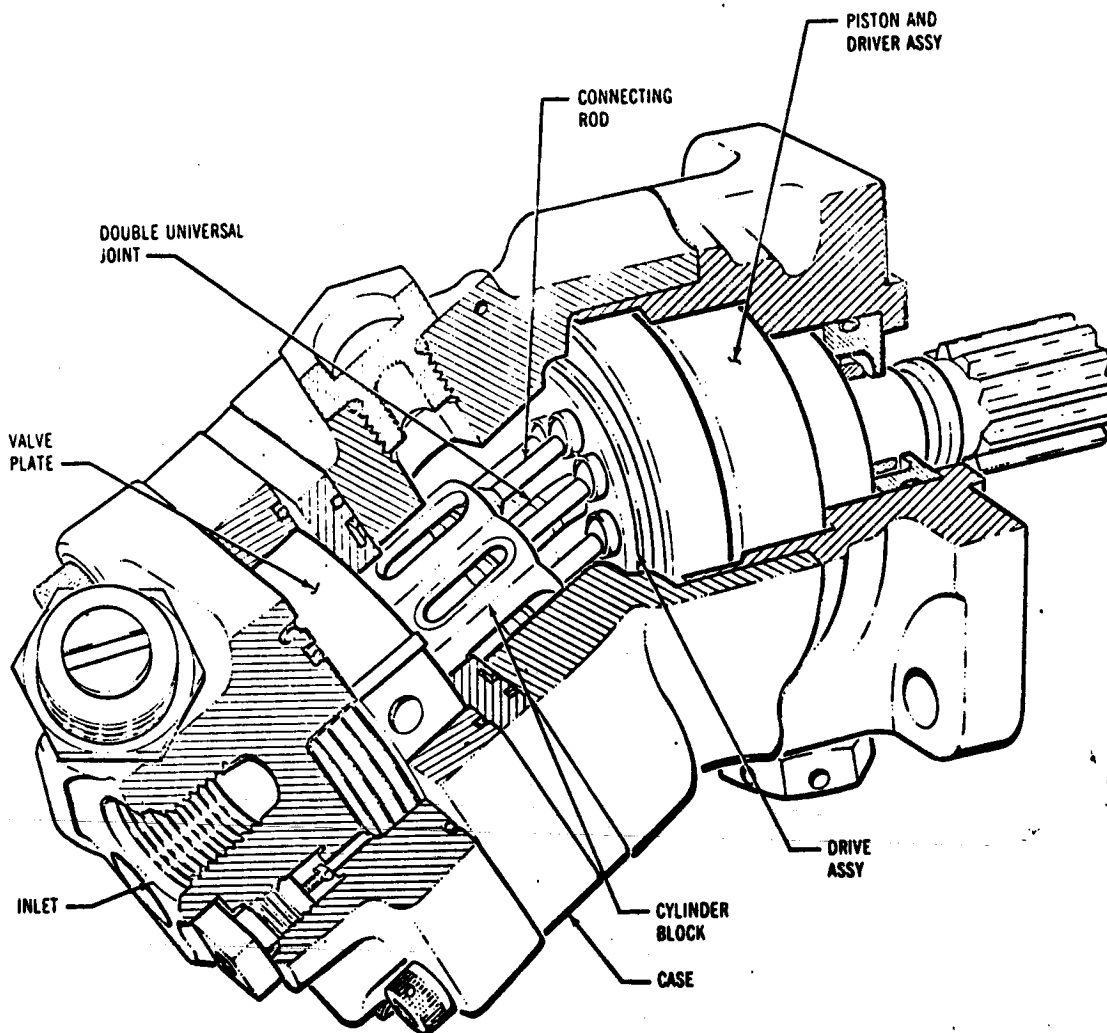
DATA SHEET	
Nomenclature: Pump, Auxiliary Hydraulic	
Drawing Numbers: 20M85064	Vendor: Vickers Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 6000 cy	
Failure Rate: $2156 \times 10^{-6}/\text{cy}$	MCBF (in cycles): 463.8
Number of Components this Data Represents: 25	Total Cycles of Operation: 2783
Number of Failures Reported: 6	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as on page 3, III.5.2	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-4 through SA-7, and SA-9 (less flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the Auxiliary Pump, Part No.
20M85064

The auxiliary pump, a single stage, fixed angle, variable delivery, nine cylinder, pressure compensated unit, supplies high-pressure hydraulic fluid to the engine hydraulic system during cold gimbaling and checkout operations.

1. Vendor - Vickers Incorporated, Model No. PV006L012B
2. Location - Station 73
3. Service - Hydraulic fluid, MIL-H-5606
4. Temperature - Operating: 0 to 275°F
5. Pressure -
 - a. Proof pressure: 4500 psig for 5 min at discharge port
 - b. Zero flow conditions: 3000 ± 50 psig
 - c. Full flow conditions: 2900 ± 50 psig
 - d. Suction pressure: 37 psia at 10,000 rpm to 65 psia at 12,000 rpm
 - e. Pressure pulsations: 200 psig maximum from 5% to 100% flow
6. Operating Speed - 10,500 rps ± 5%
7. Rated Flow Conditions - Not less than 3.0 gpm at 11,000 rpm full flow condition
8. Lubrication - Self lubricating
9. Leakage - Shaft seal leakage maximum of 5 milliliters per hour during normal operation
10. Displacement - Theoretical displacement, 0.095 in³/rev



AUXILIARY PUMP, 20M85064 - SECTIONAL VIEW

DATA SHEET	
Nomenclature: Pump, Auxiliary Hydraulic	
Drawing Numbers: 20M85005	Vendor: Vickers Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 100 hr	
Failure Rate: 55,248 x 10 ⁻⁶ /hr.	MTBF (in hours): 18.1
Number of Components this Data Represents: 4	Total Hours of Operation: 25.2
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as on page 3, III.5.2	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Pump, Auxiliary Hydraulic			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 vehicle (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Pump, Auxiliary Hydraulic	
Drawing Numbers: 20M85005	Vendor: Vickers Inc.
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 6000 cy	
Failure Rate: 2817 x 10 ⁻⁶ /cy.	MCBF (in cycles): 355
Number of Components this Data Represents: 4	Total Cycles of Operation: 492
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: Same as on page 3, III.5.2	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Burned Out Erratic Foreign Material Frozen Improper Seating Intermittent Inoperative Leaking Noisy Over Heated Operation Sluggish Out of Specs Oil/Moisture Saturation Sticking Would Not Open Would Not Close Pressure: None Low High		Indicator Shows: No Open No Close Mechanical: Binding: Broken/Cracked: Broken/Runtured: Defective: Spring, Toggle Arm, Gear Mesh Bearing: Pins/Connections Shorted: Other: _____ _____ _____ _____
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-4 Vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

SUMMARY SHEET	
Nomenclature: Ducts, Turbine Exhaust	
Drawing Numbers: 20M00013, 20M51243, 20M50621 Saturn I Vehicle	Vendor: Rocketdyne Location: S-I Stage
Estimated Design Life: 2025 sec	
Failure Rate: 97 x 10 ⁻⁶ /Sec Total Number of Components this Data Represents 49 Total Number of Failures Reported 0	MTBF (in Sec.): 10,251.4 sec Total Sec. of Operation: 14,198.2 sec Vehicle Equipment: X Ground Equipment:

Nomenclature: Ducts, Turbine Exhausts

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (including flight data)

DATA SHEET	
Nomenclature: Ducts, Turbine Exhausts	
Drawing Numbers: 20M00013	Vendor: Rocketdyne
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2025 sec	
Failure Rate: $196 \times 10^{-6} \text{ Sec}$	MTBF (in Sec): 5084 sec
Number of Components this Data Represents: 27	Total Sec of Operation: 7042 sec
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Ducts, Turbine Exhausts

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-5 through SA-9 (including flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Ducts, Turbine Exhausts	
Drawing Numbers: 20M51243	Vendor: Rocketdyne
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2025 sec	
Failure Rate: 346 $\times 10^{-6}/\text{Sec}$	MTBF (in Sec): 2883 sec
Number of Components this Data Represents: 13	Total Sec of Operation: 3993 sec
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Ducts, Turbine Exhausts			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-7, SA-8, and SA-9 Vehicles (including flight data)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Ducts, Turbine Exhausts	
Drawing Numbers: 20M50621	Vendor: Rocketdyne
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2025 sec	
Failure Rate: $437 \times 10^{-6} / \text{Sec.}$	MTBF (In Sec): 2283.8 sec
Number of Components this Data Represents: 9	Total Sec of Operation: 3163.2 sec
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

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Nomenclature: Ducts, Turbine Exhausts			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS:		SA-5, SA-6 Vehicles (flight data included)	
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

SUMMARY SHEET	
Nomenclature: Turbine Assembly, Gas	
Drawing Numbers: 454204, 4510031	Vendor: Rocketdyne
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2025 sec	
Failure Rate: $3538 \times 10^{-6}/\text{min}$ Total Number of Components this Data Represents 43 Total Number of Failures Reported 0	MTBF (in Min.): 282.6 min Total Min. of Operation: 391.5 min Vehicle Equipment: X Ground Equipment:

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Nomenclature: Turbine Assembly, Gas

FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:

DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports

CALENDAR TIME DATA REPRESENTS: SA-5 through SA-9 Vehicles (less flight data)

DATA SHEET	
Nomenclature: Turbine Assembly, Gas	
Drawing Numbers: 4510031	Vendor: Rocketdyne
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2025 sec	
Failure Rate: 8389×10^{-6} / Min. Number of Components this Data Represents: 16 Number of Failures Reported: 0	MTBF (in Min.): 119.2 min Total Min of Operation: 165.2 min Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available Acceleration: Altitude: Radio Interference: Salt Spray: Shock: High Temperature: Low Temperature: Ambient Room Temperature: Thermal Shock: Shock Impact (Flat Drop): Leakage Rate: Humidity: Random Noise: Sine Wave Method: Vibration:	

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Page 3 of 7

Nomenclature: Turbine Assembly, Gas			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-5 and SA-6 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

DATA SHEET	
Nomenclature: Turbine Assembly, Gas	
Drawing Numbers: 454204	Vendor: Rocketdyne
Saturn I Vehicle	Location: S-I Stage
Estimated Design Life: 2025 sec	
Failure Rate: $6123 \times 10^{-6} / \text{min}$	MTBF (1n min): 163.3 min
Number of Components this Data Represents: 27	Total min of Operation: 226.3 min
Number of Failures Reported: 0	Vehicle Equipment: X Ground Equipment:
ENVIRONMENTAL QUALIFICATION TESTS PERFORMED: No data available	
Acceleration:	
Altitude:	
Radio Interference:	
Salt Spray:	
Shock:	
High Temperature:	
Low Temperature:	
Ambient Room Temperature:	
Thermal Shock:	
Shock Impact (Flat Drop):	
Leakage Rate:	
Humidity:	
Random Noise:	
Sine Wave Method:	
Vibration:	

Nomenclature: Turbine Assembly, Gas			
FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS	FREQUENCY OF OCCURRENCE	FAILURE INDICATIONS
	Impedance: Low High Output: Distorted Erratic Excessive Null Excessive Roll Unwanted Signal High In Error Intermittent Loss of Some Voltages Low Low Sensitivity Low Speed No Lock On (Frequency) Noisy None Oscillation/Fluctuation Out of Specs Out of Synchronization Over Modulation Overspeed Regulation Shorted Reverses Polarity Reverses Direction		Pressure: High Low None Input: Inoperative Fuses: Blows/Blown Blowers: Inoperative Intermittent Mechanical: Pins Shorted Indicators/ Dials Are In Error Indicators/ Dials Are In- operative Lamps: Will Not Light Stay On Miscellaneous: Reported as Burned Parts Other:
DATA SOURCE: MSFC Time/Cycle Logs, Inspection and Unsatisfactory Condition Reports			
CALENDAR TIME DATA REPRESENTS: SA-7, SA-8, and SA-9 vehicles (less flight data)			
COMPONENT QUALIFICATION REPORT NUMBER, DATE AND SOURCE:			

Additional information concerning the Gas Turbine Assembly component:

The gas turbine assembly is an impulse type, two-stage unit started initially by a solid propellant gas generator and sustained by a liquid propellant gas generator consisting of the gas generator control valve and the gas generator combustion chamber assembly.

The turbine is part of the turbo-pump assembly. See page 4, III.5.1.

APPENDIX

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March 1, 1966

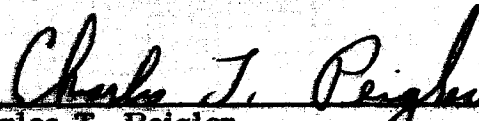
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APPROVAL

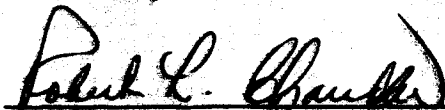
FAILURE INFORMATION NOTEBOOK

The information in this report has been reviewed for security classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

This document has also been reviewed and approved for technical accuracy.



Charles T. Peigler
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R. L. Chandler, Chief
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Peter Grau, Director
Quality and Reliability Assurance Laboratory

March 1, 1966

SR-QUAL-66-4

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